The
Electrical Review

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Power Station Staffs' Salaries

How can the schedule be improved?

THE salaries schedule formulated by the National Joint Board of Employers and Members of Staff (Electricity Supply Industry) has now been in existence for eighteen years—it was circulated to supply undertakings in 1920.

The fact that it has survived without fundamental alteration for so long proves that it has, at least, provided a useful working basis for the remuneration of the staffs of what was once considered to be almost a "sweated industry."

Although their representatives on the Joint Board had agreed to the schedule and the I.M.E.A. at its 1920 Conference recommended members to adopt it, and although the schedule received the approval of the Electricity Commissioners, it took the threat of a national strike by the Electrical Power Engineers' Association to force a number of recalcitrant undertakings to fall into line with their more enlightened brethren.

Realising the importance to the industry of a contented, efficient and well-paid staff, the ELECTRICAL REVIEW supported the Association, stating that while it abhorred strikes and hoped that milder methods would prevail, it abhorred injustice still more and whole-heartedly supported the Association's claim. There was no strike and eventually the great majority of the undertakings adopted the schedule.

There can be no doubt that the results have been beneficial to both parties to the agreement and, consequently, to the public. The improvement in conditions has attracted first-class men to the electricity supply service and, what is more, has kept them in it.

But the schedule has never been a perfect basis of remuneration, and the changing conditions in the industry have brought to light (or caused) a number of shortcomings and anomalies. Attempts to remedy these by adjustment have been made from time to time, but the original structure of the schedule remains.

The greatest advance since the schedule was instituted was probably that made in August, 1935, when, in addition to the introduction of three new classes of power stations, ranging from 150,000 kW to over 250,000 kW, the principle of increments for service was adopted. This stipulated increases in salaries after two and four years with an undertaking.

The revised rates were to remain in force for three years, so only about three months remains for the discussion of any changes which may be on the stocks. What these changes are likely to be are secrets at present locked in the bosoms of the members of the N.J.B., but it is to be hoped that due consideration will be given to the suggestions which have appeared in our pages from time to time.

The subject is raised again in this issue by a shift charge engineer, who considers that he and his kind are not fairly treated at present. We must confess that although he states his grievances he does not propound a clear solution. If there be one, which we doubt, for duties vary so considerably, it will require a great deal of wisdom to formulate it.

The same observation applies to the men in those undertakings whose operation has been radically altered by connection to the grid, either as "importers" or "exporters." The schedule was drawn up long before the grid was envisaged—or, shall we say?—considered as a practical system.

When the revised schedule was issued in 1935 we published letters from men outside the walls of the power station complaining that they were not properly catered for. The proportion of such men in supply undertakings tends to increase as stations are shut down in favour of grid supplies, and this is another direction in which the N.J.B. must exercise anxious thought.

We wish it well in its deliberations and trust that it will at least satisfy some of those who consider that they are at present being unfairly treated. We cannot hope that in such a complicated industry it will be able to produce the perfect schedule.

The C.E.B. and the N.J.B.

WHILE we are on the subject of power station staffs' salaries we think it worth while mentioning that the Central Electricity Board is not represented on the N.J.B. As the E.P.E.A. rightly says in the April number of its journal, the Board is now the largest organisation in electricity supply and the desirability of its becoming a member of the N.J.B. increases as its organisation develops and problems arise such as those in connection with parallel operation. The alteration in the structure of the industry to which we have referred certainly makes it essential that the Board should take its full share in the settlement of salaries and conditions with which it is so largely concerned.

The Budget

THE Chancellor of the Exchequer's decision to increase income tax was an unpleasant surprise to most people. The shock is mildly tempered to industry by the doubling of the allowance in respect of wear and tear of machinery. Transport operators will also look with misgiving upon the extra 1d. per gallon to be borne by petrol and heavy oils, although their discomfiture may actually benefit the electrical industry. The delicately poised balance between the costs of petrol and trolley-buses may be inclined in the latter's favour by the additional duty.

Shanghai

ALL things considered, the Shanghai undertaking got off lightly during about eleven weeks of bombing from the air and shelling by artillery. No doubt both sides realised that there was much to be gained by injuring electricity supply as little as possible. Nevertheless, the continuity of the supply given from Riverside generating station must be attributed partly to good luck. This is not to deprecate the value of the plans worked out in advance by the Power Company to keep supplies going, especially those for essential services, but the account sent us by Mr. C. S. Taylor, a summary of which is given in this issue, shows by how little disaster was avoided on some occasions. All plant that could be spared was wisely put out of commission, as a splinter striking a steaming boiler, steam main or turbine governor might result in more damage than the bomb itself, not to mention the possible effects of a short-circuit caused in the same way.

Unit Generation

MANY generating stations would appear to be over-boilered in relation to the turbines installed if one did not remember that steam-raising plant has to be laid off for repairs at fairly frequent intervals, even though the repairs may be of quite a minor character, whereas turbine runs of up to three months between stoppages may be expected. The amount of capital locked up in boiler capacity is a large item in generation capital account, as Mr. G. O. McLean shows on a later page. One of the most profitable lines of investigation open at the present stage is into the means for making an allowance of one boiler per turbine the normal practice.

Tan Phi

IT happens more often than is generally supposed that a reduction in torque of an a.c. motor is of less importance than low magnetising current losses. Moreover, the majority of machines run on average loads of less than two-thirds of their rated capacity, but the costs of reactive kVA ($\tan \phi$) have to be paid for just the same. Even if a motor is not loaded at the time of maximum demand of the rest of the plant it adds its bit to the charges under a kVA tariff. The monetary values of losses worked out by Mr. D. J. Bolton in his article this week will surprise many works electrical engineers. While these illustrate the folly of buying a machine only on the grounds of low first cost, they also raise the question of whether for many conditions flux densities are not too high. The expedient of buying a motor wound for a higher voltage than the circuit on which it is to be used will become more difficult as voltages become standardised. In return for the adoption of a standard voltage, however, manufacturers might consider offering alternative magnetic characteristics to meet conditions that are the most common in factory drives.

The Anglo-Irish Agreements

THE protracted negotiations between the Governments of Great Britain and Eire came to a successful end on Monday last with the signing of agreements settling a number of matters which have been sources of friction between the two countries for many years. The retaliatory measures imposed by the Free State in 1932 when the British Government imposed special duties to recover the equivalent of payments withheld by the Free State are to be withdrawn, as are the duties which gave rise to them, and Eire, to all intents and purposes, lines up with the other Dominions in such matters. This means that goods from Great Britain will receive preferential treatment over foreign products where such treatment is already accorded other Empire countries. All protective duties and import restrictions are to be reviewed "as soon as practicable" with a view to their revision to give British manufacturers a reasonable chance of competition. A number of classes of goods (including some electrical items) are to be freed from import duties, with the exception of "package" duty. Some further information on this subject appears in our "Business Notes."

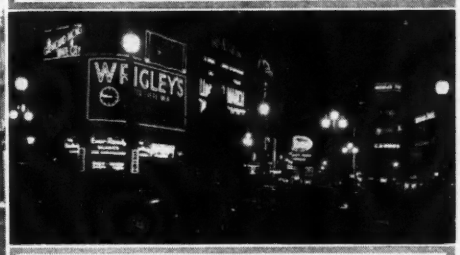
Hire-Purchase

MISS ELLEN WILKINSON'S Hire-Purchase Bill, having received the blessing of the Government, is likely to pass into law during the present session of Parliament. How it will affect electricity supply undertakings and electrical retailers is not yet clear, for the process of amendment is incomplete. Having got through Committee it is expected to come before the House of Commons some time in May. The I.M.E.A. is represented in this matter by the Conjoint Conference of Public Utility Associations, which is seeking to have amendments moved on the report stage. It sought unsuccessfully during the Committee proceedings to have public utilities excluded from the scope of the Bill. The E.C.A., whose members are also likely to be affected, is acting in concert with other bodies represented by the Hire Traders' Protection Association, which is closely watching its members' interests. The Bill seeks to put an end to serious abuses, but, for all that, it is desirable to keep a watchful eye upon it. One principal objection to the Bill appears to be its application to goods valued at up to £100. Efforts are being made to reduce this amount to £50. In Scotland, where a similar Act has been in operation since 1932, the upper limit is only £20. The provision that a hirer may terminate an agreement after paying a third of the total price is also regarded with apprehension.

Appropriate Pictures

THE example of the young bachelor living in a London flat who kept a special set of pictures in reserve for substitution for the regular ones when visited by a maiden aunt will have to be followed by our electrical authorities. A Swansea councillor observed at a recent meeting that while visiting the offices of the Electricity Commissioners and Central Board with a deputation he was pained to find that the photographs of power stations decorating the walls did not include one of Tir John. The Council decided, therefore, that engraved photographs of the station should be sent to the Board. Our reporter does not say anything about the Commissioners, but they should surely have one, too. A member of the staff might be told off to see that the appropriate photos greet deputations in future.

London . . .



. . . Intensive load building in service for three million people

IN Central London the term "commercial load" has a really special significance. The predominant factor is service to the masses of people who visit the capital every day—over three million, we believe, is a reliable estimate. For short periods these masses fill the offices, the shopping centres, the theatres, the clubs and the restaurants, each of which represents an intensity of business and recreation, of catering or of sight-seeing which probably cannot be found elsewhere in the world—certainly not in this country.

Is the load density of the area commensurable with these peculiar intensities? Probably not at the moment, but we are sure that the efforts that are being made by the City of London Electric Lighting Co., Ltd., and Central London Electricity, Ltd., for permission to investigate the activities of which undertakings we are indebted to Mr. H. J. Randall, manager and secretary of the former, and Mr. W. E. Davies, commercial manager of the latter, are equal to grasping the exceptional opportunities offered to the energetic load builder.

Mr. Davies laid stress on the necessity of constantly making contact with property owners, architects, builders and financiers interested in building. To this end, and to ensure that adequate consideration is given to the possibility of adopting electricity for all services in every new building, a development engineer is responsible for obtaining the earliest possible information regarding the sale of sites, building developments and the erection of new buildings throughout the whole area.

Potential loads are thus in hand, often before the demolition of existing property has taken place. When the necessary contacts have been made and a line of approach established for the possible application of electrical services, the job is handed over to the appropriate district sales manager who allocates it to a sales engineer for his personal attention until completed.

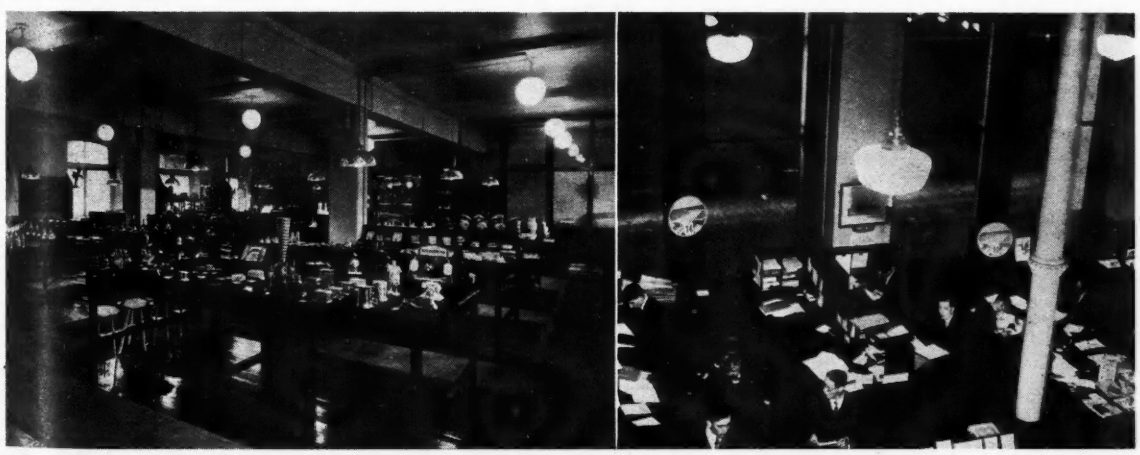
The technical staff of the "Central London" undertaking's service organisation (London Associated Electricity Accessories, Co., Ltd.), plays an important part in this initial sales work too. The men are all specialists in their various subjects and are available to any of the sales representatives. They prepare estimates for entire installations, submitting complete layouts and recommending types of apparatus.

The various connected loads of Central London Electricity, Ltd., in the West End and the City are: lighting 86,000 kW, power 74,000 kW, heating 101,000 kW, water heating 5,000 kW, and commercial cooking 12,000 kW. All-electric buildings represent a connected load of 20,000 kW and a consumption of 22,000,000 kWh per annum.

Taking the City Company's area as a whole the relative importance attached to the main classes of load from the point of view of business getting is indicated by the following: Heating (38,000 kW), lighting (40,000 kW), cooking (2,400 kW), water heating, air conditioning and power (60,000 kW). The bracketed figures are the present loads and Mr. J. Lesser, sales manager, explained why power with the greatest present load is placed last. The load comes in automatically in the City and there is never any question of gas or oil. Perhaps the only power load competition at the moment is with lifts but hydraulic lifts in the City are being replaced automatically as the old equipment wears out. Cold storage is one of the few main power users in the City area, but outstanding as an industrial load is the newspaper and printing load. The Cornwall Press, where among other journals the ELECTRICAL REVIEW is printed, has a consumption of about 700,000 kWh a year.

In the Central London Electricity area there are 250 premises where industrial heating is employed for such work as preparing blocks, colour processing and lithography, but generally in the production of books and magazines it is a potential load yet to be developed and the undertaking is looking forward to being able to convince some of its consumers that it can speed up their operations and ensure better results for less than the present cost.

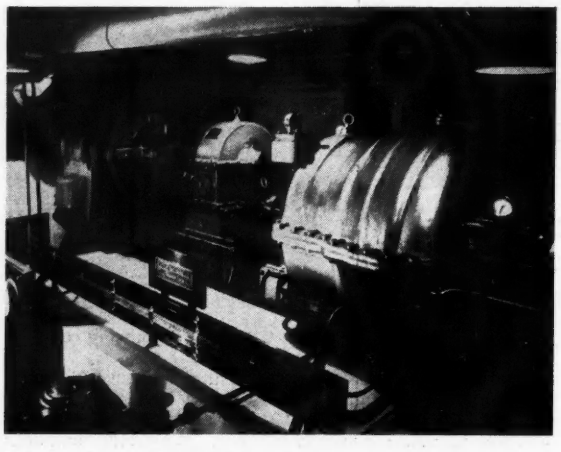
Exceptional importance is at the moment attached to office space heating. The great point is to direct the heating into the right channel so as not to get disproportionate high demands with undesirable repercussions on tariffs. The City Company finds itself building up a somewhat awkward load with electric fires. This is considered particularly undesirable



Left: Improved lighting at the showrooms of K. F. Mayer & Co. Right: General diffused lighting replaces small desk lamps at Dock House *[Elec. Rev. photos.*

for a dense commercial area because of the lack of diversity. In contrast to the rooms in a residence, all offices are occupied at the same time, and this points to caution against letting the fire load get out of control.

Indeed the whole story of City space heating centres round this question of diversity and the load cannot be allowed to develop in its own way. The problem, then, is how to develop the heating load without making a loss, and the undertaking considers that the introduction of time switches, thermostats and non-luminous apparatus provides a possible solution.



Refrigerator serving the air-conditioning installation at Prince's House *[Elec. Rev. photo.*

Where buildings still have the prospect of many years of life the problem of inadequacy of mains becomes one worthy of particularly serious attention in order to decide whether the undertaking should pay the whole or part of the cost of rising mains. The sales efforts in this type of building then are directed towards inducing consumers to adopt non-luminous apparatus with thermostatic control. Considerable success has been made in this way and the task is becoming easier.

The ideal system is one which does not make a demand during the peak period, namely local heat storage. While some hold that it is wrong to place any restrictions on the use of current, Mr. Lesser firmly stresses that if the consumer is to get the low price he desires he must make his own contribution to the solution of the problem. If local thermal storage is rejected, then properly thought out schemes of low-temperature heating employing tubes, convectors and panels, all with thermostatic control, are put forward. We saw an excellent example of convector heating at the Fleet Street offices of the Legal & General Insurance Co., where the basic heating is provided by convectors at strategic points in the corridors and staircases, while in the general offices these appliances are placed around the rooms concentrated under the windows. Mr. Taylor, of the Insurance Co.'s engineering staff, spoke of a certain difference between convector heating and central heating. He said that the convectors were giving satisfaction generally and the tendency was to reduce the number of convectors in use without discomfort to the occupants.

Rex House, in King William Street, is a large new building of 200,000 cu. ft. volume, and is heated entirely by convectors to the extent of 144.6 kW. "When new tenants come in," said the housekeeper, "they find this new system of heating strange, but it is not long before they express entire satisfaction."

To heat the Corn Exchange with its volume of over a million cubic feet with central heaters was a courageous move. The glass roof would provide a nice problem for any mathematician asked to calculate the heat losses. Anyhow, the portable 3-kW convectors on the floor and the tubular heaters on the wall round the first cornice under the windows have proved a highly satisfactory combined low-temperature scheme.

Convector heating and discharge lighting at the Corn Exchange *[Elec. Rev. photo.*

The installation at Provincial House, Cannon Street, is an excellent example of local thermal storage with its 425-kW of "Soapstone" radiators throughout the building. The whole load is time-switch controlled in four steps which are switched on at five-minute intervals. At the Chartered Insurance Institute, panel heaters supplement the basic warming from the air-conditioning plant. Mr. Lesser is of the opinion that in encouraging the thermal-storage boiler system for modern office blocks the industry is merely attaching electricity to an out-of-date system, and that the consumer is saddled with all the disadvantages of the central heating system without the flexibility of electric heating. But apart from this, to supply such a system at a competitive price the greatest difficulty is to provide a reliable estimate of the annual consumption of electricity because of the architect's tendency to play for safety under the worst conditions in calculating heat losses. After all, the margin in any case must be extremely narrow, and where is the attraction in getting a £200 profit on a 5,000-kW installation? The idea that the central heating of 50 years ago is essential in these days when efficient self-contained apparatus is on the market and sweeping reductions have been made in tariffs is not consistent with progress, it is held. But the undertaking has the courage and fairmindedness to admit that the luminous fire is sometimes the best proposition.

New apparatus is being developed by the Central London organisation, in conjunction with the manufacturers, to deal with the special problem of heating for the existing offices which originally had no central heating and where the disadvantages of handling solid fuel are more apparent than ever. It is thought that the industry has got to go a little farther than tubes and convectors. It may have to be a combination of plenum thermal-storage and l.t. radiant heating. The average consumption for space heating for offices under normal occupational hours is 1,000 to 1,200 kWh per kW per annum.

Hot Water Supplies

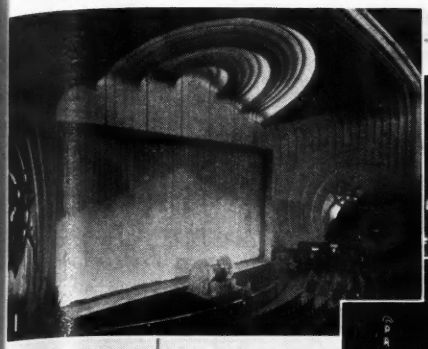
Experience in the City shows that business getting in connection with water heating is largely bound up with space-heating activities. Where success is obtained in securing the adoption of electric warming against fuel the load for water heating for wash basins is secured automatically. At Rex House two 250-gallon tanks serve the whole building for "domestic" water supplies. The tanks are lagged with asbestos carpet and each is equipped with a 6-kW bank of immersion heaters. The City hairdressing shops provide a water-heating field to which particular attention is being directed by the City Company at the moment; an interesting example is that at Fransen's Toilet Saloon in Gresham Street, where 15- and 20-gal. water heaters have been installed.

Electric water heating for offices is considered to be the most efficient and easiest method where the amount of water used is not very great. Central London Electricity told us that there are cases where, although there is central heating by solid-fuel boilers, electric water heating is used in preference to running circulating pipes through the building, with their attendant effects on decorations. The average consumption for water heating for offices is 900 kWh per kW per annum.

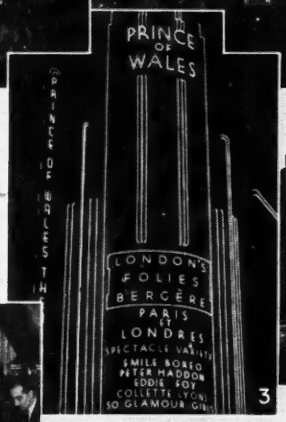
Great importance is attached by the City Company to sending out really informative literature as the first move in seeking new office-lighting business, but it is considered absolutely essential that a letter should accompany every leaflet. Sending out books without a letter leads to poor results and comparative tests have shown that ten times the number of replies have been drawn by the accompanying letter.

The outstanding feature of lighting sales effort is the placing of expert services at the consumer's demand. The specialist goes round with a light meter and demonstrates to the consumer the standard of light he is getting at the moment and offers to prepare a modern scheme of higher standard, and he submits plans showing the spacing of the points and the types of fitting recommended. The plans are then submitted to the consumer's contractor providing he is an E.C.A. member. The undertaking does not do any wiring and has also stopped its sub-contracting work. There are several reliable contractors well established in this densely populated area, and it is not regarded as wise to do anything which might antagonise these reliable salesmen.

Dock House, Billiter Street, is an excellent example of light-

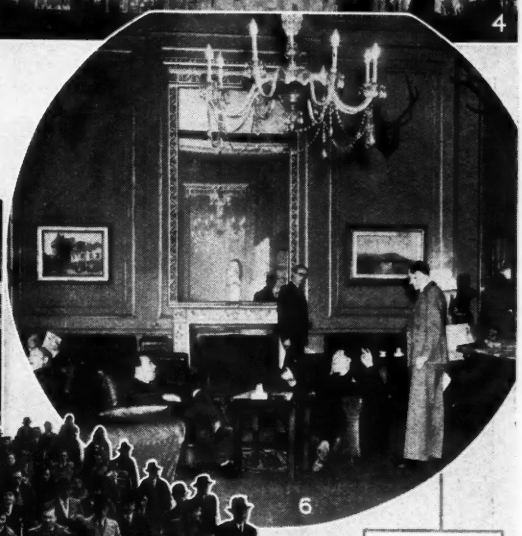


THEATRELAND
1.—Stage at Odeon Cinema
2.—Empire Cinema and Monseigneur News Theatre
3.—A display scheme at Prince of Wales Theatre

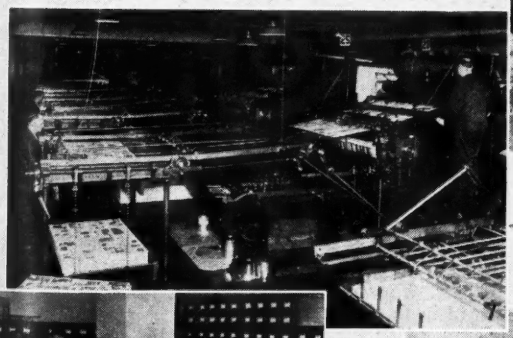


SHOPPING
4.—Peter Jones store, with its vast glass area, is successfully electrically heated

CATERING
5. — Veeraswamy's India "electrical" restaurant



CLUBLAND
6.—The Savage



INDUSTRY
7.—Where the "Electrical Review" is printed

BUSINESS
8.—Local storage heating at Provincial House
9.—Tubular heating at the offices of Alfred Bates, Ltd.
10.—Panel heaters at the Chartered Insurance Institute

[*Elec. Rev. photos.*

Electricity in Many Phases of London Life

ing improvement. The many small desk lamps serving purely as local lighting have been replaced by a properly designed general diffusion scheme, and while there is now about 6 ft.-candles generally at the working plane instead of the previous average of 1 ft.-candle, the loading of the installation has not been increased. But the lighting is, of course, vastly improved and the consumption is greater by reason of the longer period of use of the lighting. In the Corn Exchange gas lighting has been replaced by discharge lamps with every satisfaction from the point of view of light values and reasonably satisfactory æsthetic results.

The Catering Load

In the restaurants the cooking load is the one to which the Central London Electricity is extending its principal efforts. There are thousands of restaurants of all types in the area, all requiring highly concentrated sales effort to persuade men who have used, say, gas for many years and have existing apparatus of some value that electricity is the best medium for their cooking. The undertaking contends that its cooking rate of ½d. per kWh compares favourably with the cost of any other cooking medium.

Although satisfactory equipment is available for most cooking purposes, continuous research is being undertaken to obtain more efficient results. It was found that among 800 milk bars in the country not one was all-electric. The undertaking approached the Milk Marketing Board and discussed and designed in conjunction with the manufacturers suitable electrical apparatus for use in preference to "converted" gas apparatus, which very often leads to trouble. In a year ten bars have become "all-electric." Whereas for a bar using lighting and power only the consumption is approximately 16,000 kWh per annum, an all-electric bar with lighting, water heating, cooking and refrigeration consumes between 80,000

[*Elec. Rev. photo.*

Increased business has resulted from "electrical" modernisation at the "Half Moon" public-house in the City

and 100,000 kWh per annum. Milk bars, which were looked upon with a doubtful eye at first, are still opening in central London at the rate of twenty a week.

The City undertaking has hitherto been forced to curb its activities in the cooking field for the City area because of the risks imposed by putting this load on the morning peak, but as a result of the recent agreement with the County of London Electric Supply Co., Ltd., the undertaking is now looking forward to renewed activity in this direction and it is prepared to negotiate for the load on the basis of a charge of ½d. per kWh.

Public-house business now is linked considerably with that of the restaurants, largely as a result of the modernisation of premises in which electrical development has played an important part. We were told of one public-house in the east of the City where trade was found to be declining. It was decided that modernisation should be effected so as to make an appeal to a different type of customer. This modernisation resulted in quadrupling the consumption of electricity, the present consumption being 40,121 kWh per year. More than the loss of trade during the period of decline has already been recovered.

In the dense shopping centre it is largely by adequate lighting, properly designed, that London can show the rest of the world what it is doing. A future development in this section will probably be the introduction of fluorescent "real-daylight" lighting in the busy streets and shops. There are already one or two establishments so equipped.

The problem of fuel storage which faces large stores is one which can only be overcome by using electricity for heating. The off-peak system offers the most advantageous tariffs to the consumers, and at the present time Central London Electricity has approximately 20,000 kW of this type of heating, giving a total consumption of 20,000,000 kWh per annum. This load is expected to be doubled in the next five years.

Every large store now has its restaurant, and electric cooking has become well established in this field. The main difficulty to be overcome is probably the prejudice of the chefs. The average consumption for cooking of this description is approximately 1,000 to 1,500 kWh per annum and, being an all-year load, it is one of the most valuable. In the stores water heating is more often carried out by thermal-storage methods, generally with small units for very isolated lavatories.

Theatres and Cinemas

Increase in the theatre and cinema load has followed the further applications of architectural lighting and the extended use of electricity for space heating. Advertising by outside lighting is also a useful load builder, an interesting example being that at the Odeon Cinema in Leicester Square, where the intimation of the picture being shown is given by means of very large illuminated letters. There are now three completely electrified cinemas in the West End and in every case of rebuilding electricity is very carefully considered for the purposes outlined.

In the area under review there are many of the world's most famous clubs. These represent a good class of load—running from early morning until late at night. The coal fire is dying, perhaps rather hard, but in many of the clubs electric heating and new methods of ventilation have been installed. Considerable success has been obtained in using electricity for cooking. This West End club cooking is presenting problems quite different from those of the usual restaurant with its heavy-duty equipment. The hotel has to cater for quick cooking at all hours. And so in an experimental laboratory one man is engaged continuously in the search for information relating to this specialised load.

Air Conditioning Prospects

It is gradually being borne in upon the commercial world that such factors as noise, impure air and excessive temperatures and humidities mitigate against business efficiency, so that for new buildings complete or partial air conditioning is now considered. Ideal air conditions cannot be obtained without the use of electricity. Close collaboration with the medical profession is required and instances are known of surgeons refusing to operate on lungs unless the operating theatre is fully air conditioned. With all this in mind, then, Central London Electricity has a keen eye on air conditioning as a load builder for the future, and already quite a good start has been made.

In a new building in Basinghall Street, with an installed load of 240 kW and an August maximum demand of 111 kW, the summer consumption is 84,000 kWh, against 41,000 kWh in the winter, and the winter maximum demand is only 40 kW. This seems to open up quite new possibilities in load building in respect of relative summer and winter demand. An air-conditioning installation at the Chartered Insurance Institute has 78 kW of installed capacity for the compressor and air pumps and 283 kW for the plenum fans and auxiliary heating. The panel-warming equipment already referred to in connection with space heating has a total loading of 132 kW. The annual consumption for the building is 300,000 kWh, of which approximately 50,000 kWh is used by the air-conditioning plant.

The installation at Prince's House is an excellent example of the adaptation of an air-conditioning plant to an existing building. The 250-h.p. motor-driven rotary type compressor is housed in the basement and the filtering and cleaning plant is arranged on the roof. The air cooling is effected in bulk and the heating by local and individual units built into the trunking system.

Tin Research

The synopsis of the second general report of the International Tin Research and Development Council gives details of the main activities of the Council since the publication of the previous report in 1934. The present stage of progress in each of the various researches is described, electro-deposited coatings, fusible alloys and solders being included in the investigations. Copies of the above publication may be obtained free of charge on application to the secretary, International Tin Research and Development Council, 378, Strand, W.C.2.

Costs in the Boiler House

By G. O. McLean, M.Eng., A.M.I.E.E.

In a previous article (Elec. Rev., March 11th, 1938) the author examined turbine operating costs and he now deals with steam-raising plant, showing how costs are affected by steam conditions and design

STEAM-RAISING plant is the largest item in both capital and running costs of a power station. Its capital costs are generally at least 25 per cent. in excess of those of the turbo-generating plant, the proportion for buildings alone being about 80 to 100 per cent. more. Expressed in terms of the total generation capital, steam-raising plant is responsible for 40 per cent. Steam conditions having been decided in considering turbine capital costs and efficiency, boiler-makers can conform to any conditions that the turbine-makers require.

The heat curves in fig. 1 show how the boiler and economiser become less important and the superheater more important with pressure, and this importance is more pronounced with increase of temperature. The cost of superheater surface is about 40 per cent. of that of boiler surface per sq. ft., and of economiser surface about 30 per cent. In fig. 2 the effect of stop-valve pressure and temperature on the capital cost of the whole boiler unit is shown. The ordinate scale was worked out on a percentage basis, because the contracts I have considered have varied so much with the inclusion or exclusion of such items as coal-handling plant, ash-handling plant, grit extractors and chimneys, and with their types and sizes, that only such a basis proved feasible. The slopes of the curves and the steps indicate, therefore, only the general trend.

What Cost Curves Show

For comparative purposes 250 lb. per sq. in. has been selected as the 100 per cent. datum. Owing to increased tube thicknesses and size of pipe flanges, prices show a very gradual rise to a point somewhere between 400 and 600 lb. per sq. in. For convenience, 500 lb. per sq. in. has been taken, where an upward step of approximately 10 per cent. is encountered due to riveted drums giving way to forged drums, and the alteration of construction methods to suit what are now regarded as average pressures. The costs again proceed upwards at a slow rate until approximately 1,000 lb. per sq. in. is reached, when another upward step of 10 per cent. is noticeable. This is accounted for by alterations in methods of construction and the use of forced instead of natural circulation, and is no doubt responsible for the smallness of the present demand for such conditions. The definite points and chain-dotted lines are transferred from a 1933 paper on high-pressure boilers,* and it would appear that the pressure curve has flattened out. It is suggested it will still further do so as the trend towards high pressure increases.

On the temperature curve, 600 deg. F. has been taken as the starting point, and again the initial characteristic is a gradual increase in costs with temperature. The curve shows the increase in the cost of the whole boiler unit and not of the superheater alone. The latter will vary almost directly with the degree of superheating required, other conditions being constant.

These other conditions, however, seriously affect the superheater price, and are matters for agreement between the various designers. The most important of them (assuming that normal practice of convection-type integral superheaters is specified) are: Location of superheater or the number of boiler tubes between superheater and furnace; temperature of the stuff in such tubes, which is in turn dependent on feed temperature and type and size of economiser and saturation temperature; size and construction of furnace, especially with regard to what is known as the " cold fraction " or the extent of water-walling; gas quantities and velocities, which are dependent on the quality of coal and its combustion efficiency.

* " Post-war Developments in H.P. Boilers," Davy & Sparks, I.E.E. *Journal*.

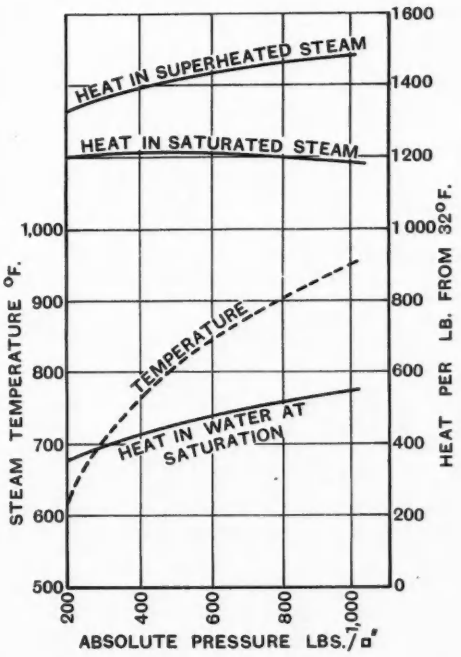


Fig. 1.—Relation between total heat and steam conditions, ensuring 12 per cent. maximum moisture at turbine exhaust

In addition to these " design " variables, the final steam temperature is influenced by the load on the boiler, the fluctuations in steam demand, the amount of CO_2 (as affected by such items as tightness of boiler setting or state of the fires) and cleanliness of heating surfaces. For all these reasons, the mean operating temperature is generally 50 deg. F. below the maximum permissible with mild-steel tubes and bolted joints, which is at present between 900 and 1,000 deg. F.

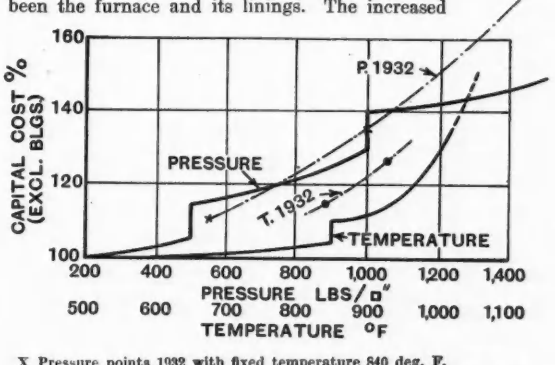
If the steam temperature can be controlled within 15 deg. F. of the design figure, the latter need only be that amount below the maximum permissible. At 850 deg. F, therefore, the costs curve steps upward owing to the splitting up of the superheater into two sections, the interposition of a de-superheater between the primary and secondary, and the use of control gear to regulate the extent of de-superheating. The curve continues to rise still more steeply beyond this transition point, as alloy steels are necessary at the higher temperatures and bolted joints give place to welded construction, while accurately controlled, independently fired superheaters are added complications, until the experimental field (indicated by the dotted portion) is entered and the curve becomes almost vertical.

Size of Plant

Thus, increase of capital cost on steam-raising plant up to pressures of 1,000 lb. per sq. in. and temperatures of 850 deg. F. is small compared with the increased efficiency of the steam cycle. Capital cost per 1,000 lb. normal evaporation per hr. decreases with output, though there is only about 10 per cent. between capacities of 80,000 and 250,000 lb. An attempt to construct a curve with capacity as the basis from figures obtained from boiler manufacturers proved unsuccessful, as the differences have been small enough to be masked by the effects of trade (the depression of 1931-33 being most marked). The size of the steam-raising unit, however, does materially affect building costs (see fig. 3). Floor space can be taken as a guide to building costs, since the heights of the boiler houses considered only varied from 70 to 90 ft., and economies can be obtained by installing the largest possible units.

Furnace Improvements

Engineers until recently have not felt the same confidence in the reliability of steam-raising plant as they have in turbines, but almost every analysis of involuntary stoppages has shown the principal cause to have been the furnace and its linings. The increased



X Pressure points 1932 with fixed temperature 840 deg. F.
O Temperature points 1932 with fixed pressure 550 lb. per sq. in.

Fig. 2.—Relation between capital costs of boiler unit and working pressures and temperatures

use of water-walls and large combustion chambers has greatly decreased the number and length of stoppages, so that it is found to be almost feasible to provide for one overhaul period per year; when this is practicable the American ideal of one boiler per turbine can be achieved.

Firing Equipment

Size of unit leads to a consideration of the firing equipment. For efficient working it has not been practicable to work at greater rates than 50 to 60 lb. per sq. ft. of grate surface with chain grates and 70 lb. per sq. ft. with retort-type stokers; spans are limited to between 30 and 35 ft. This has entailed burning the coal in a pulverised state for very large boiler units, which has been a deterrent to their use in this country.

In economy pulverised fuel has the advantage, as the capital costs of units of over 150,000 lb. per hr. normal evaporation are 5 to 10 per cent. lower than with chain grates, and the latter are about 5 per cent. cheaper than retort stokers. Their maintenance costs are now definitely comparable with those of stokers using inferior coals, and the savings incidental to higher efficiency and lower banking losses and flexibility are considerable.

The advent of pulverised fuel in this country made stoker designers "take stock," and improvements in air distribution and the use of secondary air or "overfire draught" have resulted in higher efficiencies. Stations using cheap low-grade fuels, however, ran into considerable troubles, which can be summarised by the word "slagging," of which the principal cause was the "drift" of fine coal and fly ash; the consequence has been an enforced reversion in the efficiency curve.

Given good quality coals, stoker makers can design their plant to give boiler guarantees of 87 per cent. efficiency (on the gross calorific value), but similar results can be obtained with pulverised fuel when burning low-grade fuels (fig. 4).

The grit-extraction efficiency of the ordinary cyclone or mechanical arrestor (which costs only about £0.02 per kW installed) is 50 per cent. with pulverised fuel compared with 90 per cent. with stokers. With coals of low sulphur content, electrical precipitation removes from 95 to 98 per cent. of the grit and dust. The capital cost of such plant at the present time is approximately £0.5 per kW installed.

Gas-washing Plant

Removal of sulphur gases has, however, necessitated the installation of expensive gas-washing plant at the newer urban stations, such as Battersea and Fulham, for the former of which capital cost figures have been quoted * as £1.21 per kW installed, and running costs as 0.005d. per kWh. Both the stations cited are stoker-fired, and the gas-washing plant necessary with pulverised fuel would not be any more expensive. The final argument in favour of pulverised fuel is the limit imposed on air temperatures at the chimney; the high feed temperatures necessary for the best turbine house thermal efficiency are only possible with a higher percentage heat transference in the air heater. Stoker designers recommend a maximum air temperature of 350 deg. F., whereas this can be as high as 800 deg. F. for pulverised fuel.

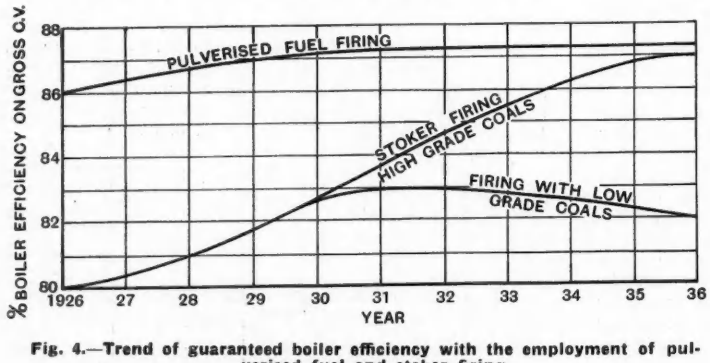


Fig. 4.—Trend of guaranteed boiler efficiency with the employment of pulverised fuel and stoker firing

Chimneys form only a small item in capital expenditure (about 1 to 4 per cent. of that of the boiler unit, depending on construction). During the last decade short unit steel chimneys gave way to taller ones, to provide better grit dispersion, but the latter suffered from corrosion with entering gas temperatures as high as 300 deg. F. Steel chimneys were then replaced by central brick or concrete chimneys, rising to a height of 300 ft., or, in accordance with the Electricity Commissioners' recommendations, 2½ times the height of the highest part of the building structure. This increased the capital expenditure, though it is argued that brick chimneys have a very long life, and, therefore, the annual charges are reasonable.

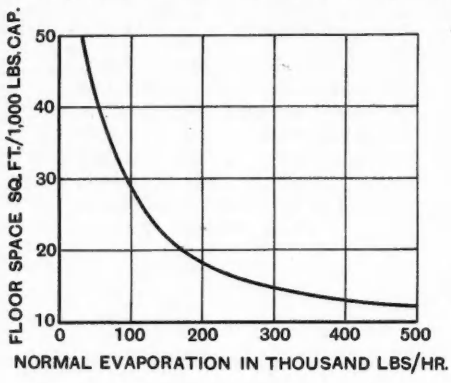


Fig. 3.—Boiler output and floor space

Such increases, however, are unnecessary, since a lined steel chimney will have a life as long as the boiler plant. Hull experienced the usual corrosion trubles with its unit steel chimneys, but central brick or concrete as well as unit concrete chimneys were rejected on the score of cost. The comparative costs, taking the lined steel chimney as the basis (1.5 per cent. of the boiler cost), were: unit steel chimney, 100 per cent.; central concrete chimney for bank of three boilers, including ducting, but excluding any possible piling, 200 per cent.; central brick chimney—of the same height and capacity as the others at the station—270 per cent.

A section of the lined steel chimneys finally erected by Mr. J. N. Waite at Hull, after a year's experiments, is shown in the accompanying fig. 5. The outer steel casing is really only protection and support for the inner lining of asbestos cement sections backed by a patented jointing compound which seals the gases from contact with the steel, and at the same time allows flexibility between the casing and the lining. It is claimed that the heat-insulating properties of the lining prevent condensation in the chimney, and also that the exterior painting periods can be considerably lengthened.

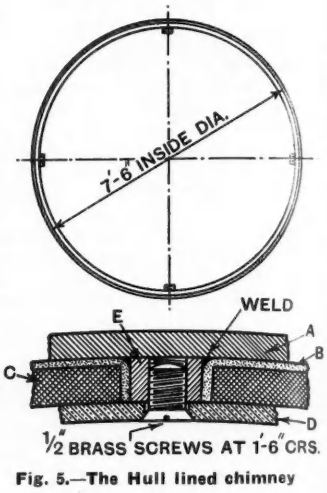


Fig. 5.—The Hull lined chimney

Fuel Cost

The Electricity Commissioners' returns show that fuel is responsible for approximately 66 per cent. of the total generation works costs. Fuel cost is a question not only of station efficiency, but also of choice of fuel, its price at the pit, the situation of the station relative to the pit, and the means and cost of transport from one to the other (on an average, freight charges are 50 per cent. of the total coal cost), and, finally, the cost of handling the coal and its treatment until it is consumed in the furnace.

Whereas coal is bought on a tonnage basis, it is its heating value that concerns the engineer—the number of B.th.u. per penny delivered to the boilers. It would assume more importance if its purchase could precede the designing of the boiler and furnace. Generally, though, the coal must be selected to suit the furnace and method of firing. A preliminary guide can be obtained by physical and chemical analyses of true average samples.

It is best to buy a fuel that incurs a minimum cost in treatment whether by drying or crushing. It is generally sufficient to judge the size of a coal by percentage weights through British Standard sieves. As moisture content at the time of sizing materially influences the results, comparisons should only be made if all the samples have been air-dried. The degree of fineness below which it is not advisable to go depends on the make, type, and condition of grate surface, firing rates, and the draught conditions, but in my experience an upper limit of 60 per cent. by weight through a $\frac{3}{16}$ in. sieve, with not more than 25 per cent. through ¼ in., for both chain

* I.E.E. *Journal*, Vol. 77, p. 35.

grates and retorts, is most suitable. With pulverised fuel sizing is not so important, as only the power for pulverising is affected and that not to any great amount.

Evenness of sizing is of great importance both as regards handling and combustion efficiency, as a coal satisfying the fineness limit already cited is not much use if the 40 per cent. remaining on the $\frac{3}{16}$ in. sieve will not pass through a $\frac{1}{2}$ in. sieve. A uniform size below $\frac{1}{2}$ in. and above $\frac{1}{4}$ in. would appear to give the best results for stoker firing.

Turning to the chemical analysis, moisture up to 12 or 14 per cent. is beneficial to combustion and is easily added on the station site. Ash to a certain extent (say, 6 per cent.) also has some value in stoker practice in protecting grate surfaces, though the effect of ash percentage on size of ash plant, handling costs, and means and cost of disposal must also be considered. A high ash percentage will adversely affect the heat transference, both the furnace temperature and the radiant heat, and the cleanliness of tube surfaces and conduction of heat.

Analysis and fusion temperature tests give valuable guides as to the amount of clinkering and birdnesting to be expected, and the periodicity of anticipated cleaning is capable of financial assessment. The undesirability of sulphur is evidenced by the damage it causes to steelwork in the gas passages of the boiler and air heaters particularly.

In regard to the wages bill, and though higher steam conditions mean more skilful attention, yet the kWh generated (or, more correctly, kWh sold) is the denominator, and large stations with high-load factors can show remarkable figures per kWh for wages. The number of attendants is not proportional to the capacity installed, and automatic combustion control has been developed to such a state that a reliable system amply repays its initial cost in savings due to maintained efficient working and reduced labour costs.

Despite more severe operating conditions, the trend over the past decade for the cost of repairs and maintenance has been steadily downwards. The principal reason for this has been the replacement of refractory lining of combustion chambers by water-walls, already referred to in consideration of boiler ratings and sizes. Bailey's paper upon "Some Factors in Furnace Design" (A.S.M.E., 1928) deals fully with the value of such walls and the heat transference of the various types, but sufficient data do not appear to be available regarding permissible "cold fraction" with average English coals, as I have found it possible to operate efficiently stoker-fired boilers with bare tubes embedded in plastic firebrick on all four sides. Incidentally, the use of plastic firebrick for repairs of refractory arches or baffles has also meant considerable reductions in material and labour for such repairs.

The replacement of refractory linings by water-walls has also meant a speeding up and cheapening of flue and tube cleaning. It is now feasible with both header-type and bent-tube boilers to use water as the cleansing tool instead of brushes, with much better and quicker results.

Trend Towards Larger Units

Conclusions to be drawn from this study of the trend of operating conditions, sizes, and general practice in this country are that it would appear economically practicable for steam conditions to rise gradually to 1,000 lb. per sq. in. and 900 deg. F. until better metals are produced—with an extension of the reheat cycle. There should also be a *prima facie* case for further extensions in the regenerative cycle with regard to (a) increasing boiler feed temperatures and the consequent use of pulverised fuel, and (b) sale of low-grade heat and gradual reduction of condensers. In view of the many economic advantages cited for larger sizes, it can confidently be expected that both turbines and boiler units will continue to increase in capacity as load and load factors increase, and new experimental plant proves its reliability.

Inexpensive Water Heating

By C. A. Kershaw, M.A., B.Sc. (Eng.), A.M.I.E.E.

The interesting tests described were carried out by the author last summer at the Northampton Polytechnic, London, where he is lecturer in electrical engineering

IN view of the potentialities of electric water heating, particularly in the thousands of houses where the domestic boiler is used in the winter and there is no alternative in the summer, some notes on a cheap and efficient application of electricity as this alternative may be of value. The method uses a 3-kW immersion heater installed in the storage tank—a system which is being increasingly recognised as fulfilling a need and which should be acceptable to the supply authority as the diversity is good. Where, however, a cooker is installed and there is any danger of overloading the service main, the immersion heater can be connected in the cooker circuit by means of a change-over switch, as it is extremely unlikely that both heater and cooker will be in use at the same time.

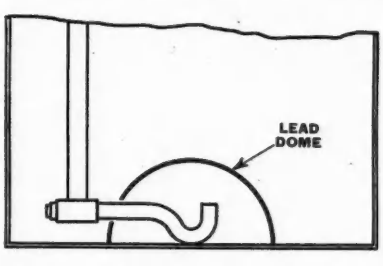
I have used this system in my own house for some years with such success that I decided to collect some information on the subject. The data given below were obtained from tests made last summer. The method used does not pretend to be ideal, but it fills the gap between unpleasant boiler lighting in summer and continuous heating, and in view of the cheapness of the installation should appeal to many small householders.

The installation is simplicity itself, as a two or three flat-bladed heater is fixed vertically in the centre of the tank and if the inspection plate is on the top, this is a simple piece of work. A thermostat can be installed, but a red indicator lamp linked in the circuit has in practice been found to be as efficacious for this work as for a cooker.

The heater actually used was a well-known make, three-bladed, nearly 14 in. long, each blade being loaded at 1,000 W and spaced approximately $\frac{1}{2}$ in. apart. The loading worked out at approximately 18 W per sq. in. and the tank was a standard 25 gal. size, 22 by 17 in. across the top and 17 in. high. For higher tanks with a smaller top area, which are often fitted in cupboards of small depth, the tests lead to the conclusion that a two-bladed heater of greater length would be more suitable, as heating cannot occur below the bottom of the heater.

In order to observe what was happening inside the tank an inspection window was fitted to each side. The head from the water level in the cold supply tank to the outlet over the measuring tanks was about 7 ft. 6 in. and all piping was $\frac{3}{4}$ in. This may be a larger bore than many outlets have, but it gave a rapid flow of water which was found to cause considerable mixing of the incoming cold water and the heated water at the top of the tank. With a light behind one inspection window a stream of cold water was clearly visible issuing from both ends of the usual tee at the bottom of the tank and eddying well up to the top. The efficiency of heating water and delivering it into the measuring tanks was in this case low—averaging 67 per cent. for 15 gal. of water. Throttling the cold feed put the efficiency up to about 75 per cent., but the best results were obtained when the end of the cold supply pipe was turned up vertically and a dome of sheet lead placed over it. It was then noticed that there was very little eddying of water outside the dome and the efficiency averaged 77.5 per cent. with an unlagged tank.

For the preliminary tests the heater was left on for 40 min. with the initial water temperature at about 70 deg. F., which is what one obtains in the summer, and 20 gal. of hot water were run off from the usual expansion pipe, 5 gal. at a time. Hot water was delivered at nearly 140 deg. at the start and this became progressively colder, and it was found that after 15 to 16 gal. had been run off the average temperature of the mixture was 104 to 105 deg., which is the usual bath temperature. For the actual efficiency tests the average temperature of only 15 gal. or 11¼ in. of tank depth was was observed, and when precautions were taken to lessen admixture of cold input the heat in the fourth 5 gal. was a maximum of



Dome of sheet lead placed over the cold supply pipe, which has been turned up vertically

4 per cent. of the input. This water is that just below the half-way line of the tank during heating and it shows that there is not a great deal of circulation of the *whole* contents, although the heater occupied nearly 14 of the 17 in. of tank depth. The orientation of the heater in the tank had no effect on the efficiency, and it was particularly noticed that the downward circulation in front of the window was negligible.

As the top of the tank reached a temperature of 145 deg. at the end of 40 min. heating, a certain amount of heat loss must have been taking place, although a rough calculation based on accepted data for bare tanks showed this to be not more than 5 per cent. of the input for the 2.6 sq. ft. of the top

of the tank during the 40 min. The top, however, was lagged with ½ in. of steam pipe lagging and a maximum efficiency of 80.4 per cent. was obtained with a lagging temperature of 104 deg. This leads to the conclusion that elaborate lagging is not required and for general use a removable cover of thick felt extending half-way down the sides would be as effective in curtailing heat loss as anything and probably be better than pipe lagging.

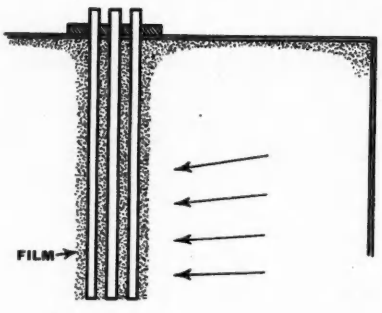
Tests were then made to ascertain what circulation there was of the main body of water, and by noting the movement of suspended matter it was observed that the heated water rose in a thin film next to the flat surfaces of the heater. This was under ¼ in. wide at the bottom and about ¼ in. wide near the top, and the upward velocity was about 1 ft. per sec. The motion of this heated water across the top of the tank was fairly rapid, but very little direct downward flow at the sides could be detected, while the colder water to replace that in the rising film moved nearly horizontally at about 1½ in. per min.

The rising of heated fluid in a thin film against a heated vertical surface is generally in accordance with theory, the upward velocity and temperature of the film falling off rapidly with distance from the surface and a boundary is quickly reached in a fluid of low viscosity like water where the conduction of heat in a horizontal direction is slower than the speed at which the water particles rise, due to reduced density, hence the existence of the thin film. This obviates the necessity for any circulator sheath with the attendant trouble due to scale formation.

Further tests were made with shielded thermometers in contact with the tank, it being assumed that these would register the approximate water temperature at the given point.

A thermometer half way down rose just over 16 deg. at the front and 12 deg. at the side in the 40 min. This shows more downward circulation at the front, which was nearer the heater than the side, *i.e.*, 8 in. against 10 in., indicating that a circular or even square tank would give greater uniformity in the heating, but these are not so usual in practice. The fair rise in temperature, however, was satisfactory as the position corresponded to 11½ gal. of heated water, *i.e.*, the beginning of the third 5 gal. delivered. With the thermometer three-quarters of the way down, however, a position corresponding to 17 gal., showed a rise of less than 1 deg. after 30 min. heating, while at the 15-gal. mark the rise was close on 2.2 deg. after 40 min.

Although the highest efficiency obtained corresponded to 15 gal. of water delivered at over 105 deg., or about 16 gal. at bath temperature, it was considered that this quantity was insufficient, and a few tests with a heating time of 50 min. were carried out, when 20 gal. were obtained at 104 deg. with an average efficiency of 82.5 per cent. The fifth 5 gal. contained none of the input heat as this was below the bottom of the heater, and on the basis of 1.35 gal. per in. depth of the particular tank used, it may have been more satisfactory to have used a 15-in. long heater in order to ensure that all the 20 gal. was becoming heated at maximum efficiency for bath purposes. Of course, longer heating would have increased the average temperature of the 20 gal. and in colder weather 60 min. would probably be advisable to get an average of 105 deg. F. For filling a 10-gal. electric washing machine it has been found in actual practice that an hour's heating gives water hot enough for the washing at over 140 deg., and the remaining hot water is suitable for rinsing.



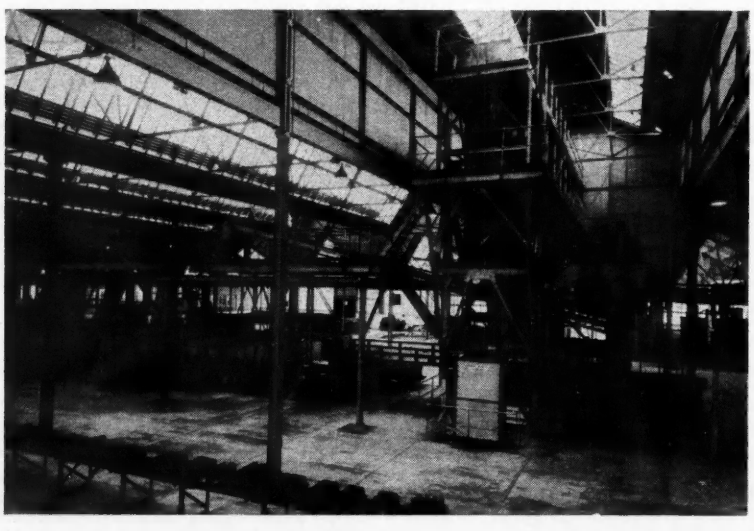
Warm water rising in a thin film next to the flat surfaces of the heater

In conclusion, it is estimated that it is possible to obtain 20 gal. of hot bath water in the summer with 50 min. heating, with a consumption of 2½ kW and the efficiency of the heating for delivery into the bath is about 82½ per cent. The lost heat goes partly up the expansion pipe, partly in radiation, and the rest in heating up piping and containers. With more elaborate systems greater efficiency may be obtained, but it does seem that the simplicity and cheapness in installation of this method has much to recommend it.

I would like to convey my thanks to the governing body of the Northampton Polytechnic, London, E.C.1, for the facilities they provided to enable me to carry out these tests.

A Mechanised Foundry

IN their new foundry at Dursley, Glos, R. A. Lister & Co., Ltd., have aimed at the production of high-grade, easily machinable castings, such as are required by agricultural engineers and engine builders, with the minimum amount of physical labour. A new building measuring 360 ft. by 170 ft. by 32 ft. has been constructed with an L.M.S. siding on one side and a well-surfaced road on the other. Raw materials are discharged by a 1½-ton magnet (Electromagnets, Ltd.) suspended from a 3-ton Morris crane and the stores are encircled by a light railway for internal transport. Two of the four 6-ton per hr. cupolas projected have now been installed. These are of the balanced type developed by the British Cast Iron Research Association and made by Geo. Green & Co.



Part of the sand preparing plant at the new foundry of R. A. Lister & Co., including the bucket elevator and the aerator. On the left is the moulding plant

Synthetic moulding sand is used, that is, silversand mixed with colloidal clay. It is said that only 1 cwt. per day is required to maintain the system-sand in condition compared with 53 cwt. with naturally bonded sand, and that the moisture in the system is reduced by 15 per cent. Sand from the knocking out of cast-up moulding boxes is centralised and conveyed to a magnet for removing tramp iron and is screened to remove other foreign matter.

An elaborate conveying system serves nine compressed-air moulding machines. The cores are also dealt with mechanically as far as practicable before being transferred to the core setters. For cleaning heavier and special castings the passage through the rotating perforated rumblers is supplemented by sand blasting, while irregularities caused by the removal of runners and risers are removed by a series of double-ended two-speed Rowland grinders. Surface grinders are also to be installed for minimising work in the machine shop. Large castings carrying heavy cores are discharged on to a vibratory screen, where the iron is recovered and the material passing through is removed by trucks to the rubbish dump.

Artificial lighting by "Osira" discharge lamps gives a general illumination of 10 ft.-candles.

Mr. F. J. Cook acted as consulting engineer and Herbert Morris, Ltd., as general contractors.

The Cost of Magnetising Current

By D. J. Bolton, M.Sc., M.I.E.E.

The author shows why the measurement of reactive kVA is the most satisfactory way of assessing power factor charges and suggests how motor users can reduce the magnetising current taken by their installations

POWER factor has always been something of a bugbear even to the technical man, and the name should never appear on tariff and other agreements that have to be negotiated by non-technical persons. Moreover, only by going beyond it and getting down to fundamentals can one correctly assess the cause of the trouble and how to cure it.

Power factor is a statement of the results, not of the cause, and a rather ambiguous statement at that. The root cause is the magnetising current, or the charging current (see fig. 1) and this is the one constant element in the situation. Provided the power consumer knows the reactive consumptions of the machines he has in use, he can tell what compensation they need and what their effect on the supply system is. A mere statement of their various power factors will tell him nothing precise about the whole, and will in any case change with every variation in the load.

The fundamental fact is that the a.c. motor requires two different sorts of current: one (in phase with the voltage) to drive it, and the other (reactive) to excite it. Undertakings have not yet made up their minds to charge separately for these two sorts of supplies, although some day they may come to this. In the meantime, they either charge indirectly (on total kVA) or, more usually, make no power-factor charge at all. In the latter case they leave their consumers free to help themselves to a certain sort of current for which no charge is made but which costs quite a lot to produce.

In assessing the costs of bad power factors, one difficulty is to find a suitable basis on which to reckon them, as there are

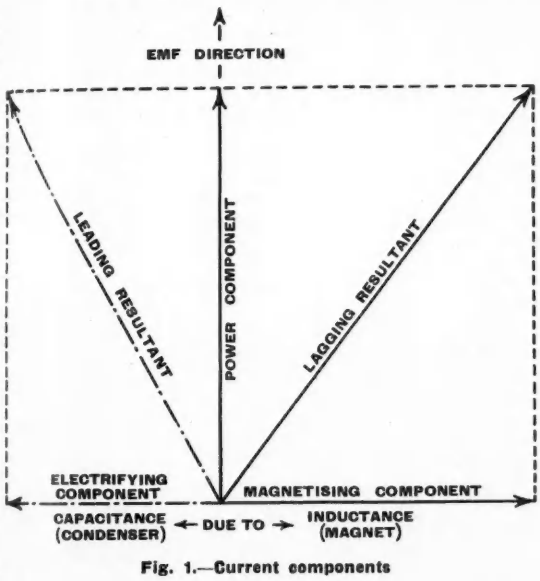


Fig. 1.—Current components

a number of variables in the problem having no simple relationship to each other. Let it be supposed for the moment that only the fixed costs are in question, and consider the vector diagram representing the consumer's requirements at the time of maximum demand. The chief quantities involved (apart from the angle of lag itself, ϕ) are (a) the power factor ($cos\ \phi$); (b) the total kVA ($1/cos\ \phi$); and (c) the reactive kVA ($tan\ \phi$). (The figures in brackets give the numerical values corresponding to 1 kW of true power.) The grid tariff has a penalty based on (a) whilst most retail tariffs penalising power factor do so on the basis of (b). On the other hand, the cause of the trouble, and the magnitude of the remedy, are both functions of (c).

The relationships between these various quantities are as follows: Over the normal range of power factor—say 0.95 to 0.65—(a) and (c) are roughly proportional to one another, the change in power factor being about one-third of the change in reactive kVA per kW of load.* But the total kVA (b) has a variable relationship with the other two, depending on the power factor position, and, in fact, the rate-of-change of (b) with (c) is at all times equal to the sine of the angle of lag. One result of this is that on a kVA tariff the consumer has more inducement to improve his power factor from bad to medium than from medium to good, even though the effect on the supply mains is the same in the two cases.

The relationship can best be seen from actual figures. In Table I below, the first line refers to the grid tariff penalty which consists of 4s. 6d. per annum per kW for each 0.1 by which the power factor falls below 0.85.

The figure which is given refers to the cost of *additional* kilovars, assuming the power factor to be already below the prescribed figure. Subsequent lines refer to a two-part Hopkinson tariff in which the fixed charge is £5 per annum per kVA of total demand. Since the rate-of-change varies, it is necessary to consider the effect of operating at or round about a number of different power factor positions.

Neither power factor nor total kVA is ideal as a basis for tariff penalties. Power factor is open to the objection that it is difficult to meter and difficult or impossible to explain to the consumer. The power factor of his machines is a highly variable quantity, and a mere statement of their separate power factors will give him no measure of the power factor of his whole load. Total kVA is also difficult to meter with any accuracy, and when used as a tariff in which all kVA are charged at the full rate (in place of kW) it is too extreme and too rigid to represent power factor costs at all closely. Because of the variable rate-of-change mentioned above, it gives unequal rewards to the consumers for equal services to the undertaking. Finally (owing to the element of phase diversity) the sum of the kVAs of all the plant connected will not give the total kVA of the load although it will be some guide to it.

Table I.—Annual fixed cost of 1kVAR of magnetising component.

Grid tariff	15 0
£5 per kVA at 0.85 p.f. ...	£2 12 7
£5 per kVA at 0.75 p.f. ...	£3 6 2
£5 per kVA at 0.65 p.f. ...	£3 16 0

Reactive kVA, on the other hand, is free from most of these objections. It can be cheaply and accurately metered, and is a logical basis of charge since it represents a tangible and necessary service rendered by the undertaking to the consumer. Moreover, it charges at a uniform rate for this service, or alternatively, it rewards phase improvement at a uniform rate per kVA of condenser. Furthermore, the reactive consumption depends chiefly upon what plant is connected rather than on how it is loaded, so that a consumer can easily estimate his power-factor liabilities. Finally, since all kilovars are in the same phase direction they can be added numerically to give the total reactive load, whereas total kVA can only be added vectorially and power factors, of course, cannot be added at all.

As regards metering, since the vast majority of machines employing magnetic fields are polyphase, it will be sufficient to consider the case of a balanced three-phase load. Fig. 2 shows how two standard single-phase supply meters can be connected to read, one the true energy and the other the

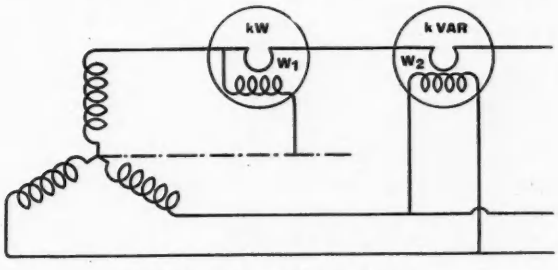


Fig. 2.—Instrument connections

reactive consumption (with the arrangement shown, the energy will be three times W_1 and the reactive will be $\sqrt{3}$ times W_2). By fitting Merz attachments to each, the same meters will record the maximum power and reactive demands respectively. A tariff can then be levied of, say, £5 per kW for the former and £1 or £2 per kVAR for the latter; and if desired a certain proportion of kVAR can be permitted free so that

*Precisely, the rate-of-change of (a) with (c) equals $sin\ \phi\ cos^2\ \phi$, and this has almost a constant value of one-third over the above power factor range.

there is no inducement to raise power factors above, say, 0.85.

The present position in this country as regards power factor penalties can only be described as extremely unsatisfactory. The most popular industrial tariffs are those of the flat-rate or block-rate type in which phase penalisation is rarely attempted. The next most popular type is the two-part maximum-demand tariff, and of these only about half use the kVA basis, and there is reason to believe that the proportion is declining. The net result is that about three-quarters of our industrial tariffs take no account of power factor whatever, and so the suppliers have no control over or means of recouping themselves for the reactive consumption.

The reason for this state of affairs is doubtless the unfair and extreme incidence of the kVA tariff and the absence of any simple and practical alternative. Supply engineers, therefore, might well look into the possibility of a kVAR or kVARh charge for the magnetising component. In the meantime, let us consider the situation as it now is, and outline the correct procedure for a consumer on a kVA tariff.

Prevention

It will be evident from the foregoing that the only way to lessen the reactive consumption is to reduce the amount of magnetising current required. At first sight it would appear that the designer has more scope for this than the purchaser, but in practice the former's activities are conditioned by the commercial necessity for squeezing the most out of his plant and so reducing its selling price. The purchaser, on the other hand, can select from among the various tenders the type and make of machine which promises best in this direction; and he can even, in a moment of rare courage, make a

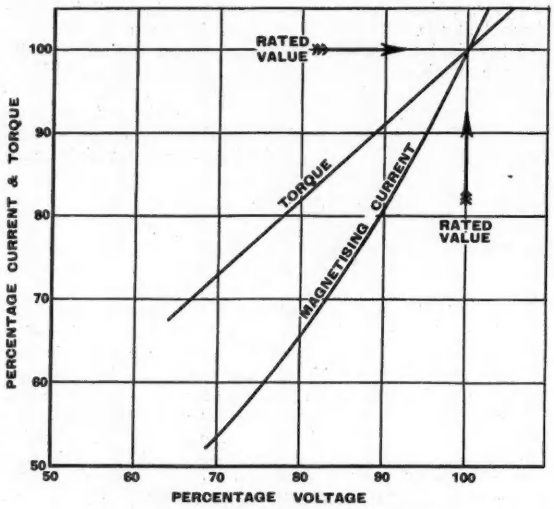


Fig. 3.—Voltage reduction performance

thoroughly unconventional choice of something bigger and better than his output requirements necessitate. Since the induction motor is the worst offender it will be employed here for illustration, but transformers can be treated similarly.

Fig. 3 shows portions of the torque and magnetising current curves of an induction motor, plotted to a base of line potential. These figures were obtained on test from a 7½-h.p. squirrel-cage machine, the load being adjusted to give a constant motor current throughout. The curves show that a given reduction in voltage gives a much greater reduction in magnetising current than it does in torque. In fact, the magnetising current follows an ordinary B : H curve plotted the other way round; in this case the iron is being worked well beyond the knee of the curve. The torque curve, on the other hand, is practically a straight line pointing at the origin. (The origin is not shown in the figure, but the two scales are identical so that the origin is proportionally distant from the starting point of the figure.)

The corollary of this is that a slightly larger motor designed for a somewhat higher voltage than the working value will give the required torque and overload capacity with much less magnetising consumption than that of the full-rated motor. The actual values in the above case were that a 10 per cent. reduction in line voltage gave a 9 per cent. reduction in torque for the same line current and an 18 per cent. reduction in magnetising current.

In order to bring these facts home to the power user, let us consider a perfectly usual duty requiring a 970-r.p.m., 400-V squirrel-cage motor with a normal output of 5 to 7 h.p. and a maximum of 8 h.p. The tariff has a fixed charge of £6 per annum per kVA. Two tenders are examined, namely, the normal one of £16 5s. for an 8-h.p. motor with a power factor of 0.82, and an unconventional one of £18 10s. for a 10-h.p. motor having a power factor of 0.83. Taking the former machine, a simple calculation involving the efficiency and power factor shows that when working at full load the magnetising consumption will be 4.9 kVAR. Moreover, this figure will be roughly independent of the loading, being only some 10 or 20 per cent. less when running light.

Referring to the table given above, and assuming that the factory is operating at about 0.75 power factor at the time of maximum demand it will be seen that the fixed charge resulting from this magnetising current amounts to 4.9×6/5× £3 6s. 2d.=£19 10s. per annum. This could be capitalised over a twenty-year life as a lump sum or present worth of about £250, which is fifteen times as much as the motor first cost. Note that even if the motor is not loaded at the time of maximum demand it will incur most of this cost, provided only that it is in circuit at the time. Note also that only the fixed portion of the tariff has been considered in the above calculation, and only one element in that cost, namely, the magnetising consumption. If all the losses and both parts of the tariff are considered the cost will be several times as great, and the present worth of the cost may be upwards of a thousand pounds.

Onus on the Purchaser

It is difficult to see who is to provide the remedy for this unfortunate state of affairs. The manufacturer is in control of the machine design and the constants employed, but it is rather too much to expect him to advertise the defects of his own wares. He may label his plant "This machine costs £10 to buy" but he is hardly likely to label it "This machine's losses cost £30 *a year* to maintain." Moreover, without a full knowledge of all the conditions of service he cannot say what the cost will be. All he could say would be that, *however* cheap the energy or intermittent the duty, his present design densities are barely justifiable. It would, therefore appear that, if anyone, it is the purchaser (or his advisers) who must move in the matter.

The power user, in fact, is rather in the position of a householder who puts out a leaking jug each day for his milk on the ground that a new jug would cost him several shillings, forgetting that his yearly milk bill costs him several pounds. Even the cost of what leaks away is in this case a considerable item.* At bottom, the power user's inaction is based on the belief that some loss is inevitable, that all jugs leak more or less. While it is true that some loss is inevitable it is equally true that a 10 per cent. reduction in loss can often be purchased by a 1 per cent. increase in first cost.

A Practical Remedy

What then is the more enlightened power user to do? Shall he range the market to find a machine with less loss, or shall he have a special machine built to his requirements? If there is a large order to be placed some such scheme is just possible, though for the most part anything special is prohibitively expensive. There is, however, a much simpler plan which involves no departure from manufacturing practice and no quotations outside the printed price list. All that is necessary for this is to order the next larger size of machine and specify a voltage higher than the one on which it is to run. A comparatively small reduction in voltage will reduce both the magnetising current and the iron losses in a far greater ratio than it will reduce the torque, and bring them down to an economic figure in comparison with the first cost of the motor itself.

The answer to the query raised above is therefore seen to lie in the alternative "unconventional" quotation previously given. If the 10-h.p. motor is ordered for a line voltage of 500 it will give slightly more than 8 h.p. on 400 V with the same current, owing to the higher efficiency. The curve in fig. 3 shows that at 80 per cent. voltage such a motor will have 66 per cent. magnetising current, and as the rated reactive consumption for the larger machine is 5.79 kVAR, the consumption on the lower voltage will be 5.79×0.66=3.8 kVAR. This means a saving of 1.1 kVAR over the smaller machine run at its rated voltage, which is worth approximately £4 7s. a year on the above tariff. Since this can be purchased for an extra first cost of £2 5s. it represents an annual dividend of nearly 200 per cent. on magnetising current alone, quite apart from the saving on the iron losses.

(*Concluded at foot of next page.*)

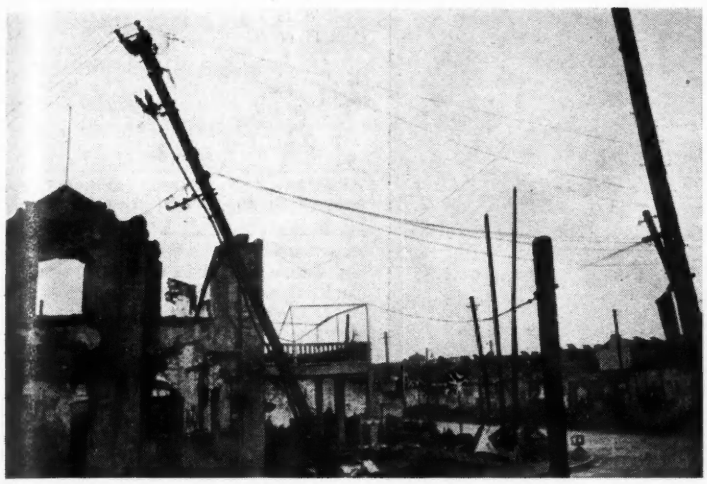
* It is true that the consumption considered in the present article is not true power—*i.e.*, it is the froth on the top rather than the liquid itself that is being lost. But since the liquid has to be pumped along a pipe in an expensive distribution system the froth occupies valuable space and costs money.

The Shanghai Power System

Maintenance of supply in difficult circumstances

These notes, received from Mr. C. S. Taylor, Consulting Engineer to the Shanghai Power Co., detail the damage inflicted upon the company's system during the Sino-Japanese conflict and show how the company has carried on in spite of it

ELECTRICITY supply in Shanghai was not seriously affected by the Sino-Japanese conflict until the town became the scene of major hostilities on August 13th, about five weeks after the initial outbreak in North China. Practically the whole Eastern district of the Settlement north and east of Soochow Creek was isolated from that date until the end of October, when the Chinese forces withdrew. This district contains the Riverside power station, the gas works and waterworks, the wharves and shipping warehouses, more than half of the large industrial plants and the greater part of the small industries.



Typical line damage in Urga Road

The Riverside station of the Shanghai Power Company is situated on the Whangpoo River at the extreme eastern end of the Settlement. Four of the nine principal sub-stations, with capacities of from 15,000 to 35,000 kVA, serving the Settlement and the Extra Settlement to the west are also situated east of the Soochow Creek. There are also ten distribution sub-stations in the district which are supplied at 6.6 kV from the principal sub-stations.

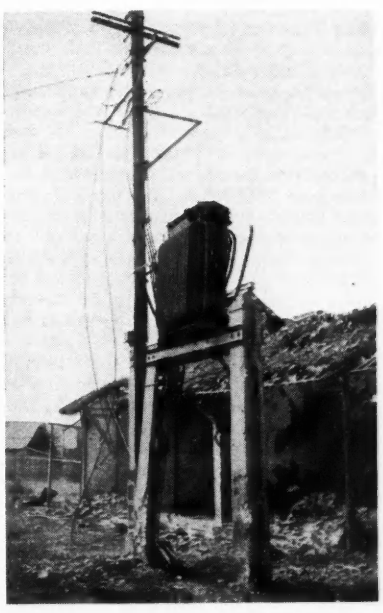
The worst damage was caused by fires in the congested alleyways, and nearly a square mile of small houses was completely wiped out. Alleyway mains are run from the road mains attached to brackets on the houses, up to a hundred consumers being served from a single alleyway system. It was estimated that 10,000 services were included in the burned area, and all the meters, mains and services were a total loss except for the scrap value of the copper. A few of the large mills were damaged by bombs or shells, but unless a fire had been started the damage was usually confined within a short radius. The total load lost in the burned alleyways was nearly 30,000 kW, reducing the total connected load to about the 1932 figure.

Half the damage to the Power Co. property has been in meters destroyed innumerable places. Tops of poles were shot off and hung from the wires, and many poles were partly burned through by the heat of fires in adjacent property, but few fell down or required immediate replacement. Twenty transformers (mostly out-of-doors), varying in size from 62.5 to 940 kVA, were removed for repairs. As a result of machine gun fire or shrapnel over forty holes were counted in one transformer tank. The oil had been drained off from all. Damage was almost entirely confined to the tanks; seldom were the coils punctured. In the Western district several transformers, varying in size from 62.5 to 3,000 kVA, were also damaged by machine gun fire.

Comparatively little damage was done either to buildings or indoor equipment. A shell went through the roof of a sub-station in the Extra Settlement Roads district of Northern Hongkew, and an open wire connection between the main and sub-feeder boards was broken. Other small shells struck the Fearon Road sub-station, one of the principal sub-stations in the Eastern District, breaking windows and doing some minor damage to the walls, the 23-kV auxiliary bus and a potential transformer. Although about 25 per cent. of the company's supply area was fought over, bombed and shelled and about 10 per cent. of the area burned, property destroyed represents less than 0.5 per cent. of the total value, largely because both parties recognised that it supplied an essential service.

The closure of the Eastern district and the general stoppage of business following the bombings of August 14th caused the maximum demand on the Riverside station to drop below 25 per cent. of normal for the first few days. Recovery was soon apparent, however, and by the middle of October the load was again approaching normal in the Central and Western districts.

The Riverside station, with about 183,000 kW installed, is the largest in China. Greater Shanghai is served by three other stations (one of which was put out of commission soon after the opening of hostilities) having a combined capacity of about one-third that of Riverside. The station stands in the midst of a group of large Japanese cotton-spinning mills which, together with a golf course about a mile from the station which has been converted into an air field and the various warships and transports in the river, provided targets for repeated raids carried out by Chinese aircraft.



A pole transformer which maintained its equilibrium

A detachment of forty United States marines established nine defence posts at different points. They were of inestimable value in dealing with attempts by undesirable individuals

Magnetising Current *Continued from page 610*

There is one important limitation to the above procedure. Although for a given motor current the torque is only reduced as the first power of the voltage, for a given *speed* the torque is proportional to the voltage squared. This means that the starting torque and the pull-out torque of the larger motor when under-run in a 500/400 V ratio will be only 80 per cent. of the values for the standard 8-h.p. machine. A safer plan would therefore be to order the large motor for 440 to 460 V and then run it on 400 V.

This would have three effects. It would reduce the magnetising current and the iron loss. It would also reduce the copper loss; this is very important, since it is usually the largest of the losses, and in the event of a two-part tariff it has the biggest effect on the fixed charge. The total economic gain would probably be about the same as before (depending on the exact service conditions and tariff construction) but the proportions would be different, and in respect of the item discussed in this article the saving would be less. It would, however, still be many times greater than the cost, and well worth doing on a kVA tariff unless power-factor correction plant is to be installed.

or parties to enter the plant and in maintaining the morale of the operating staffs. The property was clearly marked by large flags (six floodlighted after dark) which were visible to aircraft.

Little could be done to protect the station from bombs and shells, but some protection against flying shrapnel and machine-gun bullets was obtained by placing sandbags and steel plates in front of some of the windows. The operating engineer's desk was also completely enclosed by sandbags. As a precaution against results of broken steam pipes and short-circuits on electrical equipment, No. 4 boiler house, containing four 350 lb. per sq.in. powdered-fuel boilers rated at 210,000 lb. per hour each, and the three associated 25,000-kVA turbo-generators, were shut down. The 23-kV auxiliary bus-bar was also de-energised.

A shattered transformer and (right) another which escaped with less serious injury

During September there were fourteen night air raids about the plant and forty-two during October. On October 14th a bomb made a hole 30 ft. in diameter and about 6 ft. deep in the station yard. A 3-in. shell landed on the roof of the turbine house but fortunately did not explode. Other unexploded shells and large quantities of shell and bomb fragments have been picked up in the yard and on the roofs of the buildings. The outside walls have, in many places, been marked by machine gun bullets.

How the Staff Fared

The normal staff at Riverside includes about 120 foreigners and over 1,000 Chinese. Most of the foreign staff live in the Western Settlement and Extra Settlement districts and in the French Concession and drive from their homes across the Garden Bridge, but on August 14th the latter was closed. The company's two tugs and a hired tug were therefore used to transport the staff to the power station, a distance of about four miles. As night trips were too hazardous the staff was placed on 24-hour shifts.

Fearon Road sub-station is the headquarters of the operating department, including the system control engineers, the maintenance and construction staffs, the meter and transport departments and the stores. On August 14th firing started in the streets around the sub-station and the offices and workshops were closed, but the motor generators supplying the traction and d.c. lift circuits in the Central district continued in operation. Two armoured cars were quartered in the yard and the operators were placed on 24-hour shifts.

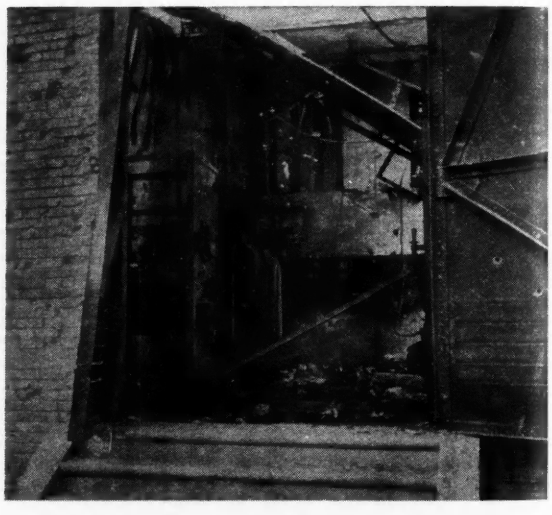
On August 17th there appeared to be a danger of the station being wrecked, so the armoured cars were withdrawn and the operators with them. The motor-generators were shut down but the 23-kV and 6.6-kV feeder boards and the outgoing 6.6-kV feeders left alive. The traction and lift circuits were transferred to another sub-station. At Yangchow, another principal sub-station, the situation developed very much in the same way and the operators were also recalled.

The 23-kV feeders supplying the entire load of the Settlement south of the Creek and Western District Power Co. run the full length of the active fighting zone. The danger of a shell or bomb cutting 23-kV cables and causing a lengthy shut down of one of the western sub-stations was very great, so arrangements were made with the French Electric Light & Tramway Co. to pick up a limited amount of load in case of a complete failure of supply from Riverside.

The only interruption of supply to any of the main sub-stations occurred on the night of August 16th, when a shell damaged two 23-kV feeders. After a short interruption supply was re-established over a 23-kV tie with the Western District Power Co., a subsidiary of the Shanghai Co., from which it takes a bulk supply. The break in the cables was repaired on the 21st. Two other 23-kV feeders were damaged at inaccessible points and had to be left out of service, but other feeders operating in parallel with these were sufficient to carry the loads. Faults on the 6.6-kV cable system resulted in total shut-down of three 6.6-kV sub-stations for several weeks.

On August 24th non-Oriental gangs were permitted to operate in the southern half of the district, re-connecting services, repairing damaged mains and disconnecting damaged transformers and services. No Chinese were permitted to cross Soochow Creek. The northern half of the district was closed altogether until the middle of November, except for work of military importance. Work had to be discontinued on many occasions on account of shelling.

The line crews confined themselves to repairing the 6.6-kV and low-voltage road mains and the street-lighting circuits. Very little road main copper was lost and in most cases the broken ends of the wires were connected together by Crosby clamps. There were almost 2,000 breaks in the roadway mains and still more in the street-lighting circuits. About the middle of November permits were obtained to take the regular Chinese crews into certain parts of the district, and since then repairs to underground cables have been proceeding.



A devastated switchroom (Tien Yuen Electrochemical Co.)

Repair work has been carried out under considerable difficulties as not only were the Chinese mainsmen limited as to their movements but passes had to be secured for the non-Oriental gangs from the Japanese consular and military authorities for presentation when entering the Eastern District, when a list of places to be visited had often to be given. Even then permission might not be granted or a Japanese guard accompanied the party. Although there has been little shelling or bombing since regular repair work has been started, these were for a time of almost daily occurrence, and in several instances lines repaired only a short time before were again brought down.

Many of the homeless Chinese residents, including women and children, flocked to the power station and sub-stations and coping with this situation was in itself a complex problem which the company was called upon to solve.

The Television Service

Achievements and prospects

FOUR papers by six authors were submitted at an unusually crowded ordinary meeting of the Institution of Electrical Engineers, held jointly with the Wireless Section, in London on April 21st. The papers were all closely interrelated, being descriptive of different aspects of the television service conducted by the British Broadcasting Corporation from Alexandra Park

The paper by Messrs. T. C. Macnamara and D. C. Birkinshaw (of the B.B.C.) is divided into five parts. The first is historical and the second discusses the circumstances that influenced the establishment of a high-definition service. The third and fourth sections describe apparatus and means of control; arrangement of studios, their acoustic treatment, ventilation and production lighting. The fifth section is concerned with mobile transmitting vans and cables employed for televising outside events; while the sixth is a brief consideration of reception results and the various types of available receiving sets and aerials, a field-strength map being included.

The average field strength created by the vision transmitter is 85 per cent. of the sound-transmitter intensity. The radiated power varies from 17 kW at peak white to about 1.5 kW at black, with little radiation during synchronising signals. The average radiated power is thus comparable with that of the sound transmitter, which operates with a carrier-wave power of 3 kW.

Field strength measurements have been made at distances of from 50 to 800 km. in a northerly direction and the range of the station at Alexandra Palace has in practice exceeded the original 25 miles forecast. Good reception is obtainable up to 35 miles, except where exceptionally bad interference is encountered. The two most serious forms of disturbance are caused by motor-car ignition and by high-frequency electromedical appliances of the diathermy class. The former is most widespread and the latter very violent. Interference from a hospital which was suppressed by completely screening the diathermy room reappeared at its original intensity when the screened door was opened by only a few inches.

There appears to be a general tendency to standardise cathode-ray receiving tubes of 12-in. screen diameter, giving a picture of 10 by 8 in. Larger tubes present problems related to the effects of atmospheric pressure. There is no definite evidence as yet regarding the relative merits of electrostatic or magnetic focusing and scanning, or a mixture of both. It is generally conceded that direct viewing gives more satisfaction, though the use of a mirror enables a cabinet of more convenient shape and smaller size to be employed.

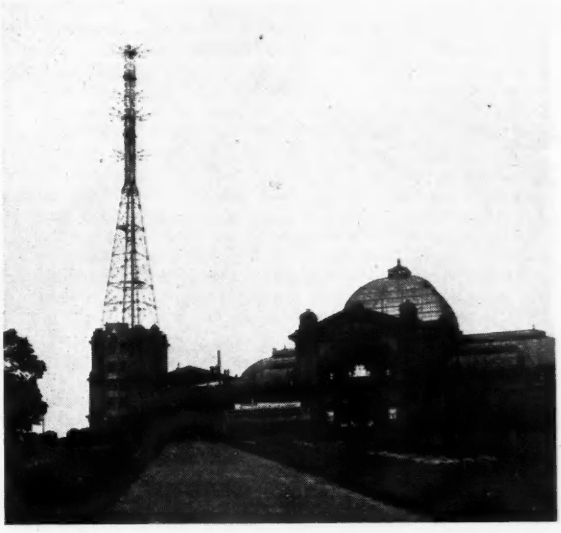
Various aspects of this service, in which British engineers have led the way, were dealt with in papers read at the I.E.E. last week. Interesting contributions to the discussion were made by Sir Noel Ashbridge and other speakers

The height of aerial is of great importance and by mounting a second unfed half-wave dipole at a distance of one-quarter wave behind the receiving element, a gain of two or three db in received signal strength is obtainable. The effect of standing waves due to the presence of metal roofs, drain pipes, neighbouring steel-frame buildings, &c., is considerable. Material changes in received field strength can be brought about by moving the aerial only a few yards.

Televising Outside Events

In summarising the paper, Mr. T. C. Macnamara paid more attention to means for televising outside events, describing this branch as the more important on account of topical interest. He mentioned the successful use of normal telephone-type cable links, the construction of a "fire escape type of extending aerial truck," and subtle kinds of interference with short-wave radio link transmission.

The paper by Mr. A. D. Blumlein (Electric and Musical Industries, Ltd.) deals with the transmitted wave form, and suggests two slight modifications of the published specification. The proposed amendment seeks to fix the number of frame pulses at eight, instead of indefinitely between six and twelve. Also it is hoped that in future the method of film transmission from the Alexandra Palace station (now interspersed and sometimes worked in conjunction with studio pictures) will be altered so as to allow the minimum ten-line interval between frames to be realised from the transmitter. Such a change might appear to be trivial, but the author claims that it represents a 5 per cent. improvement in effective picture detail and is therefore considered to be well worth while.



[*Elec. Rev. photo.*

The television transmitting aerial at Alexandra Park

The contribution by Mr. C. O. Browne (E.M.I., Ltd.) describes the vision input equipment supplied to the B.B.C. station, comprising the studio equipment, "Emitron" camera control apparatus, modulation amplifiers for the radio transmitter and associated gear.

The last paper by Messrs. N. E. Davis and E. Green (Marconi's Wireless Telegraph Co., Ltd.) is concerned with the short-wave radio vision transmitter employed at the London television station, including details of the Marconi-Osram valves available for the particular requirements. The Marconi-E.M.I. method of modulation described by the authors is akin to that employed in the radio transmission of black-and-white facsimiles.

The subsequent discussion was opened by Sir Noel Ashbridge (Controller, Engineering, B.B.C.), who said that this group of papers represented co-operation in the overcoming of difficulties that would have daunted many large organisations. During the eighteen months in which the London service had been in operation it had given very satisfactory results, but it must be appreciated that studio equipment cost five times as much as sound equipment for the same amount of work and television apparatus cost one hundred times as much as sound apparatus. At the Alexandra Palace station there were 61 engineers compared with thirteen at the Manchester sound station, which was of comparable size. One of the greatest problems of the moment was how to train a sufficient number of engineers quickly enough in a technique that was extraordinarily complex. These were some of the reasons which had prevented other countries from commencing similar services.

Sir Noel commented on the remarkable reliability of television receivers; they were not any more difficult to adjust than ordinary sound receivers and their performance, good as it was, could be further improved if certain kinds of interference could be got rid of. The studios at Alexandra Palace were being enlarged, but even so they would still lack adequate facilities for rehearsals. The possibility of extending the service beyond London involved a choice of means of linking transmitters which would not be too costly and would be subject to the least interference. One of the brightest aspects of the subject was that the coverage (range) of the present station had not yet reached its limit. The standard 405 line transmission could not last for ever and efforts to produce larger received pictures would be beneficial.

Mr. A. J. Gill mentioned types of cable usable for long-distance transmission, remarking that the use of telephone type cable now being tried by the B.B.C. offered a solution of the problem of linking up outside events. The E.M.I. Co. had laid eight miles of balanced cable in its laboratories merely for test purposes.

Mr. J. E. Condliffe said that the selection of a 405-line transmission system was a compromise between the ideal and practical limitations. The establishment of a 441-line system in Germany was unfortunate. The difference between the two was not enough for the observer to notice in the pictures; the existence of two standards was unnecessary and would be an obstacle to the exchange of programmes internationally.

Mr. G. C. Marris said that the number of correcting circuits needed for the "Emitron" camera made him wonder if it was the right thing to employ. Results obtained by other means compared very favourably with those at Alexandra Palace. If correction were to be required at the receiver as well as at the transmitter, both of which were liable to wander, trouble would be caused. The true cost of receivers was causing anxiety and it was not obvious where drastic cuts could be made. They must watch carefully how demonstrations were conducted, because too much picture contrast was not suitable for home use.

Mr. L. H. Bedford considered the choice of 405 lines a bold step; that system had worked well, but with that standard the cost increased at a greater rate than the value of entertainment improvement resulting therefrom. The problems of the moment were not technical, but economic; more programme variety was obtainable by international relaying, but that necessitated international standards.

Mr. P. W. Willans confined his criticism to the system, not details, remarking that the pressure of haste did not allow alternatives to be properly evaluated. Commercialisation had driven the authorities to standardise the wave-form. The Ballard system of interlacing was optimistic. Mr. F. R. W. Strafford spoke of aerials for mobile transmitters, and expressed his satisfaction at the fact that British names were behind everything that had made television possible in this country.

Mr. L. E. C. Hughes agreed with the contention that gamma (contrast factor) should be unity, since adjustment of artistic contrast was best done at the receiver; if it were done at the transmitting end, too much onus would be placed on the engineer. When one viewed pictures 5 ft. across one began to criticise cameras rather than transmission or the receiver. The use of more film transmission in television programmes would permit more time for rehearsal and so reduce studio congestion.

Mr. D. C. Birkinshaw, in a brief reply, enlarged upon the need for rehearsal facilities. He could not agree to neglect synchronisation interference, since a slight displacement could cause a most grotesque picture instead of one merely marred by interference. For large received pictures the production technique would need to be very different from that which sufficed for small pictures. He could not imagine what would happen if half of the television receivers that were in use by the public produced large pictures while the other half remained small.

Sir George Lee, president, in proposing a vote of thanks, expressed his admiration of the courage, initiative and technical skill that had made television possible in England. So far as extension of the service range was concerned, the Post Office maintained an open mind regarding which system should be used. But it was favourably situated for the development of underground cables, and in that respect the P.O. was doing all it could do.

Electrolytic Plant and Processes

Chemical Engineers at the I.E.E.

THE principles of design and operation of plant for electrolytic processes are dealt with in a paper by Dr. H. J. T. Ellingham, which was submitted at an extra meeting of the INSTITUTION OF ELECTRICAL ENGINEERS jointly with the INSTITUTION OF CHEMICAL ENGINEERS in London on April 27th.

The author first describes the nature of electrode reactions and accompanying chemical changes. He next explains the conditions necessary for the occurrence of these effects, pointing out the influences of electrode potentials, electrolytic polarisation and current efficiency or density. Thus, in some cases, the simultaneous occurrence of two or more electrode reactions is desired (for the electrodeposition of alloys) but usually the aim is to obtain only the product, or products, of a single reaction. The occurrence of other processes would then represent wastage of current, and variation of current density may materially affect the current efficiency and even cause the type of reaction to change almost entirely.

In some cases the onset of a second reaction may change the condition of the electrode surface in such a way as to hinder, or prevent, the process of the first reaction. In other cases the occurrence of the first reaction may bring about conditions which stifle its own progress, by producing a film on the electrode surface which will permit polarisation to increase to a sufficient extent to enable other reactions to take place.

The two chemical changes are separate and distinct, that taking place at the anode being an oxidation process and that at the cathode a reduction process. The quantity of electricity entering and leaving the cell is the same, but the two reactions can nevertheless be separately controlled. This is done by varying the current density, by using electrodes of differing sizes and shapes so as to alter the area in contact with the electrolyte. Not only can the compositions of the two electrodes be quite different, but it is also possible to maintain the composition of the electrolyte around the electrodes differently. This is done by the interposition of a diaphragm, which separates the anolyte from the catholyte.

The author defines the minimum voltage necessary for electrolysis to occur and the minimum energy needed to bring about chemical change. He classifies the various electrolytic processes and outlines the principles of cell design, materials of construction and arrangement of component parts. The operating conditions are summarised and the influence of temperature indicated.

Successful operation of many processes depends on the presence of substances other than the principal reactants in the electrolyte. The energy consumption per unit weight of product may be as large as 25 kWh per kg. for aluminium extraction or as low as 0.4 kWh per kg. for copper refining. The majority of electrolytic processes need less than 5 V per cell, but the current required may be 30,000 A per cell (for aluminium extraction). Thus a recently erected copper refinery has 416 tanks connected in series to give a total drop of 65 V when the current is 8,750 A; and a zinc extraction plant has 144 tanks in series taking 10,000 A at 580 V. Several groups of tanks in series may be connected in parallel. The most suitable grouping of cells will depend on the means available for supplying the requisite d.c.

Most large-scale electro-metallurgical processes are continuous in operation, but many types of electrolysis can with advantage be worked at off-peak periods and can thus be made to maintain a high load factor.

Fluid Couplings

SOME of the problems that arise in the transmission of power by fluid couplings working on the principle originated by Prof. Föttinger are dealt with in a paper by Mr. H. Sinclair (Hydraulic Coupling & Engineering Co., Ltd.), which was read before the INSTITUTION OF MECHANICAL ENGINEERS in London on April 22nd.

The author employs the unusual expression "steam squirrel-cage motor" to describe the combination of a s.c. motor with a scoop-controlled coupling in which the scoop tube is permanently fixed in the full-speed position. Such a unit is very suitable for driving feeders, conveyors, and so forth, which are liable to be stalled, possibly by some temporary overload which will remove itself or can be cleared. With a "solidly" coupled motor such conditions cause the overload trip to operate frequently, which is a nuisance, for example, in bucket dredger drives.

The fixed scoop coupling will transmit a high overload, up to the pull-out torque of the motor, with only a modest increase in the slip. When this limit is exceeded the motor slows down and the runner of the coupling smoothly stalls so that liquid from the working circuit empties rapidly into the scoop tube chamber, the torque on the motor decreases, and within about ten seconds the motor speed and current have returned to normal, while full load torque is maintained at the output shaft. As soon as the cause of the overload is cleared the driven machine will automatically accelerate, and the working circuit is refilled by the pumping action of the fixed scoop tube. The general effect is that of giving a useful steam characteristic to a simple form of electric motor.

The paper describes means of reducing residual, or stalled, drag torque in the case of winch, crane and similar drives that involve frequent starting and reversals of rotation. The fluid coupling brings the load automatically up to speed at a rate in inverse proportion to its inertia, or torque. In many such cases the coupling is also required to act as a load-limiting device.

Means of obtaining creeping speeds are described for machines which commonly need main and pony motors, and other applications of fluid couplings dealt with include capstans for operating lock gates, conveyors, reversing motor drives, centrifugal separators, and machines utilising the flywheel effect for such cyclic duties as forging and pressing.

New Apparatus and Devices

for Domestic, Cooking and Heating, Lighting, Power and Scientific Purposes

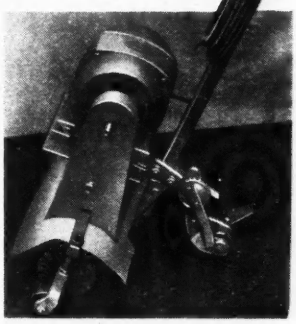
Street Lighting Lantern

A new street lighting lantern of the directional reflector type has been designed by the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2, for use in side roads.

The unit consists of a single piece of glass, blown in a mould to an unusual design, and an aluminium alloy top. The absence of metalwork around the glass greatly increases the reflecting surface.

As the glassware is free from colour undue light absorption is avoided, and the special design of flutes gives the required diffusion without internal glass losses. The contour of the glass ensures high beam angle for road brightness, 170 deg. non-axial beam for side of road mounting, and secondary control of beam, producing rapid run-back of polar curve towards the pavement, with a blunt-nosed beam on the road side.

The light distribution produces good visibility when the lanterns are mounted 15 ft. above the ground and 120 ft. apart, in accordance with Ministry of Transport recommendations. Lighting is also given to first floor windows. The glass will be stocked in two finishes to provide a magnification ratio of just under 4 to 1.



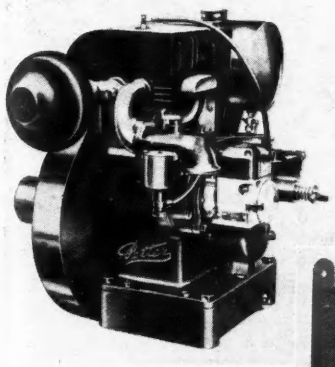
An electric floor cleaning machine

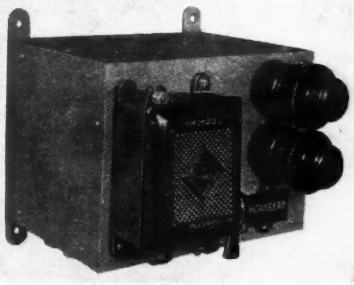
A two position lamp-holder ensures the correct location for 80- or 125-W "Osira" high-pressure mercury vapour lamps. The same gallery can be supplied with different attachments for 100- and 150-W filament lamps (b.c. holders) or 150- and 200-W lamps with e.s. holders.

The smooth interior of this all-glass reflector simplifies cleaning, and it is easily detachable for periodic washing and the silvered surface is guaranteed for five years.

Air-cooled I.C. Engines

Considerable reduction in weight and size is claimed by PETTERS, LTD., Yeovil, for their new four-stroke single-cylinder engine which runs on petrol or paraffin. It is made for outputs of 1½ h.p. at 750 r.p.m., 2 h.p. at 1,000 r.p.m., and 3 h.p. at 1,500 r.p.m. Splash lubrication is adopted and the governor gear runs in an oil bath. Air cooling is effected by a flywheel impellor which directs air at high velocity past a deflector around deeply finned cylinder head and valve pockets. Starting is facilitated by a variable jet and strangler fitted to the carburettor. Speed can be varied by 20 per cent. while the engine is running by a centrifugal governor which complies with B.S.S. No. 765-1938, which permits 12 per cent. temporary change and 6 per cent. permanent change of speed from no load to full load. Air-cooled engines are especially suitable for tropical countries where there is a small margin only between temperatures of the ambient atmosphere and of boiling water.





Above: Petter air-cooled i.c. engine. Right: One of the new low-voltage transformers of F. C. Heayberd

A Floor Cleaning Machine

Specially designed for cleaning the floors of garages, engineering shops and other buildings where oil is used, the improved electric floor scrubber, designed by F. G. BROWN, 26, Algers Road, Loughton, is of interesting and unusual design.

The usual method of cleaning oil deposit from floors is by scraping—a long and tedious method. This new equipment comprises a pair of stiff wire brushes, turning on ball bearings and driven through a roller chain by a ½-h.p. electric motor running at 1,400 r.p.m. The brushes are covered by a metal guard and the motor is mounted externally and above them, the operating handle being similar to that used on a vacuum cleaner, the flexible cable being also stored between two hooks on the handle.

On each side of the frame are adjustable rollers which take the weight of the machine when the handle is in an upright position, but as the handle is inclined for use so the weight falls on the brushes.

The normal method is to go over the floor with the blades at the back of the machine in the working position (at a small angle to the floor) to cut through the deposit. After flooding the floor with an alkaline emulsion the brushes can be used to remove the deposit, after which the dirt is swept or hosed away.

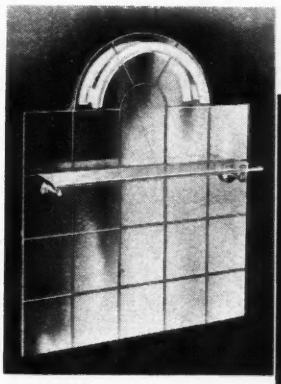
It is stated by the makers that the hardest and thickest deposit can be removed at the rate of about 100 sq. ft. per hour, equivalent to the work of six men.

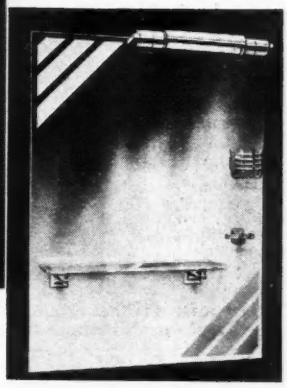
Illuminated Mirrors

A common practice in modern houses is to have lighting fittings combined with the bathroom mirrors, and many examples are being made by VALBANIA, LTD., Cavendish Works, Hartington Road, South Lambeth, London, S.W.8.

Single-ended tubular lamps, frosted and rated at 25 W, are employed to give the illumination, and control is by means of a push switch through the mirror. Both frameless and framed mirrors can be obtained, the frames being chromium-plated. The decoration is in stippled silver.

These mirrors are also made, in frameless form, as illuminated cabinets either recessed or for surface mounting.





Two of the illuminated mirrors by Valbania, Ltd.

Infra-red Lamps

Last year the GENERAL INDUCTANCE CO., 28-34, Fortess Road, London, N.W.5, introduced its first "Giplex" appliance, a four-heat hair dryer. To this has now been added an infra-red lamp with a heavy gauge spun-copper reflector, chromium-plated over nickel, the rest of the appliance being finished in a combination of cream and chromium plate.

The lamp may be had either as a hand model, as a table model with a clip to a cast iron base which clamps to the table, or as a floor model, all embodying the same type of heating element. At a lower price there are models with polished aluminium reflectors.

Low-voltage Transformers

A range of low-voltage transformers, specially designed for use with handlamps, has just been brought out by F. C. HEAYBERD & CO., 10, Finsbury Street, London, E.C.2.

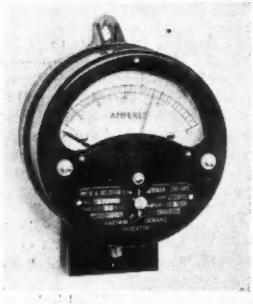
These transformers are double wound and built in rigidly strong weather- and dust-proof steel cases suitable for wall or bench mounting. An earth shield is fitted between the primary and secondary winding of the transformer, and is connected to an earth terminal. Eight models are available, rated as follows: 12 V, 60 or 100 W; 25 V, 100, 250 or 500 W; and 50 V, 250, 500, 750 W.

The illustration shows a standard wall mounting type with a double-pole mains switch-fuse mounted on the front panel and two insulated three-pin plug and socket connections for the handlamps. This type of transformer can be mounted in any position and one or two hand-lamps operated, as required.

D

A Maximum Demand Indicator

The "P & B" maximum demand indicator for consumers' installations is now available in a bakelite case which may be either black or walnut as preferred. The complete movement is flexibly mounted on springs with felt buffers, and this, combined with the special chain friction device, overcomes unwanted movement of the idle needle due either to tampering by a consumer or vibration.



The "P.B." maximum demand indicator

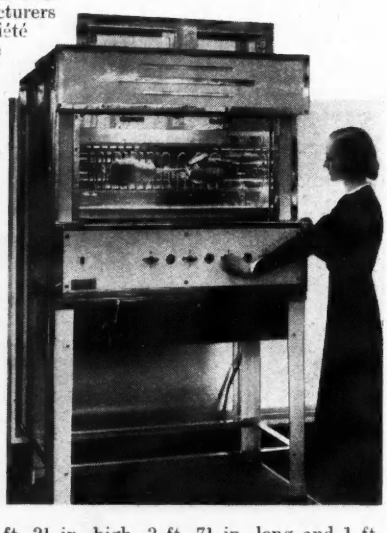
The bi-metal coil movement is of the usual "P & B" type with one moving part only apart from the maximum pointer, and is fully compensated for changes in ambient temperature. The maximum pointer is of the knife edge pattern. The resetting knob is positively locked by means of a small trigger which can be sealed by either a wire or a padlock and all the scales are individually drawn and may be single or double, in amperes, kVA or in special units, as required. The time lag may be 15, 20 or 30 min., as specified.

Thirteen standard capacities are made giving a range of sizes from 2.5 to 100 A nominal full load, plus 20 per cent. to allow for overloads.

An Electric Chicken Roaster

At the Regent Street showrooms of Central London Electricity, Ltd., is an electric chicken roaster, which the company is handling in this country, the manufacturers being the Société d'Electricité et de Mécanique, Brussels, Belgium.

The total loading is 4 kW in the form of reinforced "Calrod" rustless steel elements situated in front of a chromium plated steel reflector. There are eight elements, two for each chicken, and a pilot light is incorporated.



The electric chicken roaster at the C.L.E. showrooms [*Elec. Rev. photo.*

The roaster is 3 ft. 3½ in. high, 3 ft. 7½ in. long and 1 ft. 10½ in. deep, excluding the stand, the dimensions being external overall.

A rod fitted with prongs for holding the chickens in position is fixed in front of the elements. This rod revolves at a suitable speed, being driven by an electric motor situated in the base of the roaster and controlled by means of an independent switch. The front of the apparatus consists of two doors fitted with "Pyrex" glass, allowing inspection of the cooking without opening the doors.

Electric Clocks

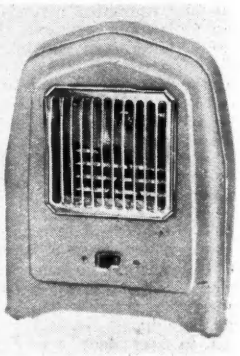
A full range of "Goblin" electric clocks is now being manufactured by the British Vacuum Cleaner & Engineering Co., Ltd., London, S.W.6. Cases are available in oak, birch, walnut, maple, mahogany and ebonised wood, all except the cheaper models (which, incidentally, are guaranteed for two years) being obtainable with either a battery-driven or synchronous movement. The "Capricorn" combined wall clock, barometer and thermometer is an interesting innovation. A combined table lamp and clock in oak is also being made, and for bedroom use there are many attractive styles.

Left to right: The "Goblin" combined clock and barometer, Smith's "Steyning" chrome and glass model, and the lowest-priced "Goblin" clock

Many new designs have also been introduced by Smith's English Clocks, Ltd., Cricklewood Works, London, N.W.2, including low-priced wooden cased models, chrome and glass designs and large 6-in. dialled wooden cased models. In addition there is a range of clocks mounted in Empire woods.

A Fan Heater

Batwin Electric Motors, Ltd., 138, Southwark Street, London, S.E.1, are now supplying a unit comprising a 1,250-W heating element behind which is a twin-bladed fan designed to circulate the warm air. Nichrome helically wound elements are employed, and as the motor is of the induction type the fan can only be used on a.c. The weight is 9 lb., and the finish green.



The "Batwin" fan heater

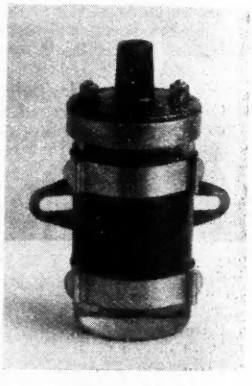
Three-phase and D.c. Motors

Another recent development of the Batwin Company is a range of three-phase and d.c. industrial motors, known as types "SF" and "SK." Special attention has been given to the slot linings of mica, Empire cloth and "Leatheroid," and d.c.c. round wire is used for the stator windings. The stator stampings are subjected to a continuous flow of air which circulates through the motor. Before impregnation the windings are stoved twice. Close-grained grey iron is used for the castings of the end flames and the small size of the vent openings prevents contact with rotating parts. The rotor windings on slip-ring motors are banded to prevent movement and the high conductivity bars on the squirrel-cage rotors are brazed to the end rings. The slip rings are of a special bronze alloy.

An Oil-immersed Ignition Coil

Two unusual features of the new oil-immersed ignition coil of Runbaken Electrical Products, 13-15, Liverpool Road, Deansgate, Manchester, 3, is that both the primary and secondary windings are fitted in a hermetically sealed insulation oil container made of an unbreakable transparent material.

The immersion of the winding in oil increases its insulation properties, enabling the coil to operate at a higher voltage than is usual, and in addition the circulation of oil accelerates cooling and the dissipation of heat.



The Runbaken ignition coil

Although designed primarily for racing cars and heavy duty engines where high efficiency is necessary, the coil gives excellent results on all types of cars, and is produced by the makers for both 6- and 12-V systems.

Quick Boiling Kettles

A kettle to boil one pint of water in two minutes is being marketed by the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2. This speed is effected by the existing model "D.5243" when supplied with a 2,000-W element. The "D.5245" is also available with this element fitted. This loading makes for quick boiling with all sizes of kettle. The time taken in minutes is shown below:—

	Capacity in pints	Loading	1 pt.	2 pts.	3 pts.	5 pts
D.5243	3	2,000 W	2	4	5½	—
D.5245	5	,,	—	4	5½	9

Kettles fitted with 2,000-W elements cost slightly more than the 1,500-W types.

Salaries Schedules

By Power Engineer

Unsatisfactory features which need attention

The existing N.J.B. schedule of salaries was instituted in August, 1935, for a period of three years. Its retention or revision is now the subject of discussion which makes this article opportune

USUALLY it is difficult to find men prepared to give up time to assist in formulating a salaries schedule and for those that do there is generally nothing but criticism. Constructive criticism is essential, but how best to apply it is another matter. By voicing opinions at meetings is one way, provided the salient point is not forgotten in the heat of discussion. Although the schedule is for the benefit of those in the electrical industry there are many who enjoy its benefits but do little, other than grouse, to assist in its construction. It is the help of such men that is now required when schedules are discussed.

Some of these men are not members of the E.P.E.A. and the numerous existing anomalies leave loopholes for them to escape by when approached on the subject of membership. With these points in mind it is suggested that use might be made with advantage to all sides of the columns of the technical Press. It will be remembered by many older members of the profession that the ELECTRICAL REVIEW generously opened its columns for the ventilation of grievances in the pre-war days, in fact, before the actual formation of the E.P.E.A. Since that time this journal has published opinions on this important subject which should help the committees at present in session with their great task.

Probably one of the greatest anomalies which exists in the present salaries schedule is the allocation of grades. The numerical designation is inadequate. This was one of the main points raised when the supplemental schedule was adopted and opinions were expressed in the ELECTRICAL REVIEW of August 2nd, 16th and 23rd, 1935. These opinions also attracted attention in the columns of the official organ of the E.P.E.A. (September, 1935), where it was stated that "the technical staffs must have been struck by the similarity of opinion which exists in regard to the defects in the schedule of salaries."

Why is not more attention given to seeing that switchboard attendants enjoy N.J.B. conditions? There may be some confusion regarding the respective duties of switchboard attendants and control room attendants, but is there any difference? I refer, of course, to control room attendants and not control engineers, whose duties are quite different. Some time ago it was decided to take a census to ascertain the position regarding these grades, and I hope the findings will be embodied in the revised edition of the schedule.

The Shift Engineer's Case

With regard to the shift charge engineer I consider it time that he was raised in grade and general status; in fact, in some undertakings this has already been done. Some may argue that he requires no special technical qualifications, merely the ability to command and look after the routine jobs specified by his superiors. This may or may not be so, but where the technician may sit and consider his problems before making a decision the shift charge engineer must act immediately and apply the proper method. He must make decisions without consultation and answer fully for his misdeeds.

He may not have the responsibility for laying down the plant, although at times his practical knowledge would be an asset, but he has the responsibility of running it and keeping it running. Grouses are raised regarding his hours compared with those of other people in the industry, his remuneration and the effect of shift work on his general health. Conditions would be better if the job were considered a stepping-stone to something better, but nowadays once a charge engineer always one.

In the earlier correspondence on the matter of grading the question of duties arose. I maintain that for stations of equal capacity salaries should not vary; even if station design improves so that operation is much easier the responsibilities are no less. In the rapid progress which took place in the early days would anyone have suggested a drop in pay when four 5,000-kW sets were superseded by a 20,000-kW set? It may have been easier from a switchman's point of view, but did it relieve the engineer of any responsibility by placing all his eggs in one basket?

At present payment is made on a plant capacity basis with a percentage increase if a successful claim goes through. No individual claim should be necessary, and it is to be hoped that this will be successfully thrashed out in the new schedule. The basis of plant capacity would appear to be reasonable providing a fixed percentage increase in pay is stipulated for all stations taking energy from the grid; export stations are automatically covered. An importing station would, in the natural course, have been of greater capacity had it not been decided that it should be served by the grid. I fail to see why the staff should be the victims of circumstances over which they have no control.

Perhaps a little elucidation from persons to whom the maximum demand basis is understandable would show this method to be the better, but a specific comparison requires to be set out before acceptance of either. The latter method would cover control room operators and control engineers more fairly but it can hardly cover certain station engineers.

Position of Non-station Men

Throughout the whole of these expressions, it will be noticed, the case of station men is stressed. I cannot voice the feelings toward the schedule of distribution or sales men, nor can I see that we have anything in common with either. I leave these men to state their own case for they will not see our point of view or we theirs. On this score alone it would appear most essential that any schedule put forward should cater for individual sections of this vast industry. Already in many quarters difference of opinion exists regarding the question of sales engineers. Will evolution result in the E.P.E.A. being governed by sales and distribution men to the detriment of power supply men? Such a development cannot be looked upon with favour by power engineers, particularly those who have had to work so hard to get recognition.

Other points which need clarification are the definition of time worked extra due to members of the staff being absent through sickness, and the grading of relief men. The system of incremental advances seems quite fair to both newcomers on a job and the older men, but does it cover the case of relief men? Surely a definite ruling could be laid down for these men so that they could attain the full rate of pay by a system of periodical increments.

With the termination this year of the supplemental agreement it is to be hoped that a revised schedule will come into operation adequately catering for all grades in a manner fair to both employers and employed.

New Books

Electricity. By A. GREEN. Pp. 221; figs. 207. London: Sir Isaac Pitman & Sons, Ltd. Price 6s.

It is a little difficult for the ordinary academically trained engineer to understand books like the present, written for craftsmen and technical students. The book is one of four designed to cover the syllabus in elementary physical science set for the First Handicraft Examination of the City and Guilds of London Institute. The objects of this syllabus are to relate elementary scientific principles to their application in everyday life and to enable candidates to approach with confidence the making of simple working models and the performing of experiments with improvised apparatus. Admitting the underlying virtuous intentions, we still fail to see how a mass of disconnected facts presented in a descriptive manner can be of much lasting benefit. Already, on page 7, we are told how "thunder rain" is produced, though but two pages are given to frictional electricity. Presumably, explosions in operating theatres might equally well have been given, but what does the student learn by such treatment? The idea seems to be to state a few facts about a subject, say, electro-magnetism, and then to illustrate the various applications from lifting magnets to motor horns and telephones. In this way all manner of electrical appliances and plant receive mention—even the choking-coil lightning arrestor.

Half-way through the book units are dealt with, and we are introduced to a few symbols and calculations, and thus advance a little beyond the intelligent newspaper or magazine reference. But we do not like a student to be taught that it is cumbersome to use two instruments to measure d.c. power, nor that "in d.c. circuits the e.m.f. and current always reach their maximum and minimum values simultaneously, *i.e.*, they are 'in step' with one another." Again, take the heading: "Lost volts in dynamo or cell." Of course, one can see what is meant, but cannot the craftsman understand the simple, straightforward language of the schools? Why must he be compelled to extract the truth from such strange verbiage?

Heating by electricity gets a rare knock-out blow: "With

energy at the low rate of ½d. per unit, a two-unit fire which would be required for a moderate-sized living-room would cost 1d. per hour, an almost prohibitive cost in competition with other forms, and so low a rate as this is seldom available." Here we part company with the author—and with his book.

L'Electricité dans les Exploitations Agricoles. By R. B. Matthews and R. H. Drilhon. Pp. 697; figs. 581. Paris: J.-B. Baillière et fils. 150 fr.

This book (which is written in French) covers the wide range of applications of electricity that have a possible bearing on rural conditions, starting with a brief study of the factors involved in the electrification of sparsely populated areas, and the protection and control of consumers' circuits. Lighting, motors, heating, tractors and transport, pumping, milking, electro-culture and domestic usages are among the items dealt with. Two final sections discuss distribution questions and tariffs.

Strom- und Spannungswandler. By Dr.-Ing. Michael Walter. Pp. 159; figs. 163. Munich: Verlag R. Oldenbourg. Price Rm8.80.

This concise and excellently produced volume gives a useful treatment of the operating characteristics and applications of current and voltage transformers as used for measuring, metering and relay purposes in commercial service. Instrument transformers for test beds and laboratories are not considered, these being generally of special types. Constructional features are clearly illustrated, but this side of the subject is only dealt with so far as it relates to the main object of the book, *viz.*, the explanation of the capabilities of the various types of transformers and the requirements that can be imposed on them.

The range of the treatment is from the elementary principles of instrument transformers, with following chapters on the main types of construction, their characteristics, applications and circuit arrangements, to notes on the protection and selection of transformers for various purposes. The two main sections of the book, on current and voltage transformers respectively, are both arranged on this general plan; and, throughout the apparatus, data and practice are in accordance with the German standards.

Besides the information on the capabilities and uses of the different types and classes of transformers and circuit arrangements, engineers in practice will specially appreciate the chapters on the dynamic and thermal effects of short-circuits. A concluding section deals with the testing of instrument transformers from the user's standpoint, and includes notes on motor-driven and static instrument "transformers" for d.c.

Mechanics for Engineering Students. By G. W. Bird. Pp. 158; figs. 111. London: Sir Isaac Pitman & Sons, Ltd. Price 5s.

This textbook for students of the third year of the Ordinary National Certificate Course was planned by the late G. W. Bird on somewhat unconventional lines and its main feature was the large range of worked examples with which it was provided. The majority of students taking this examination are accustomed in the workshop or drawing office to learn by seeing things done, and therefore more readily get to grips with a subject by seeing its application to practical cases as it develops from stage to stage. Because of its exemplification of this idea and, perhaps, too, on account of the informal nature of its diagrams, it has proved a popular and successful book. It now appears in a third edition, revised by G. W. T. Bird, as one of Pitman's National Certificate series, and, apart from some minor alterations and additions, is substantially the same book.

The work opens, rather unusually, with stress and strain and treats them in an elementary manner, and it is here that the one serious fault of the book occurs, for nothing whatever is said of Young's modulus of elasticity, though it is necessarily made use of in the examples. Six chapters are devoted to the development of the strength of materials side of the subject, and subsequent chapters give adequate consideration to dynamics, simple harmonic motion, force and acceleration, and hydraulics, so that after a careful study the student should have a good knowledge of the fundamentals with which to proceed to the higher course, when it can with advantage be treated more analytically.

Shorter Notices

"The Broadcaster 1938 Radio Annual" (price 5s.), published by the *Wireless Retailer and Broadcaster*, is colour-coded into four parts: statistical, technical, legal and commercial, and directory. There are "first-aid" quick test data for nearly 100 sets; characteristics and prices of 2,500 different valves; a thirty-page "service" section; a directory of the voltages in 8,000 towns; the officials and details of the fifty radio associations; "Who's Who" entries for 250 personalities, and the addresses of manufacturers, wholesalers, and agents. A map gives exact details of where the Alexandra Palace broadcasts are being received, and a television section tells how an installation should be carried out. Statistics include quarterly licence figures for 500 districts, a survey of the electrified homes in 1,000 areas in the British Isles, and radio export and import trade figures.

The current copy of the journal of the National Institute of Industrial Psychology, Aldwych House, London, W.C.2, is in a new form as a quarterly under the new title of "Occupational Psychology," which should enable authors to discuss their subjects more critically and in more detail. The sections devoted to reviews and abstracts have been considerably enlarged, and the more ephemeral news is to be noted in two monthly bulletins, one industrial and the other educational.

"Reid's Handy Colliery Guide for Northumberland, Durham, Yorkshire, Cumberland, and Westmorland" (price 3s.) has just been issued by A. Reid & Co. in revised form with a map of the area and details of the Coal Mines Act, 1911, and the various statutory rules and orders issued since that date.

"Principles of Electric Power Transmission and Distribution." By L. F. Woodruff. (Pp. 257; figs. 146.) Price 17s. 6d. "Photo-elements and their Applications." By Dr. Bruno Lange. (Pp. 297; figs. 67.) Price 27s. 6d. London: Chapman & Hall, Ltd.

Electrical Imports of Ceylon

LAST year there was an increase of about 25 per cent. in Ceylon's imports of electrical goods, compared with 1936, the respective totals being 3,231,000 Rs. and 2,604,000 Rs. The machinery group did not contribute to this increase, which was shown rather in the lighter apparatus. The United Kingdom remained the leading supplier. Details of the trade are given in the following table, which is based on the recently issued official returns. (The rupee=1s. 6d. at par.)

Ceylon's economic prospects and purchasing power are dependent very largely on the state of the world's markets for tea, rubber and copra. In rubber a severe decline has taken place and copra also has been on the down grade. Recovery in rubber waits on a resumption in American demand and therefore Ceylon is looking anxiously to the United States. Fortunately, however, the tea market has been less depressed than others and that commodity is about twice as important in Ceylon's export trade as rubber and coconut products combined.

Another favourable feature from the point of view of purchasing power generally is that Ceylon has still a big reserve of advantage from the very satisfactory prices realised for her products before the recent slump occurred. The Savings Deposit Index for January to November last year was 169.7 as compared with 149.2 in 1936 and 135.2 in 1935.

	1937 Rs.(000)	Inc. or dec. on 1936 Rs.(000)
Control and switchgear—		
*Total	151	+ 68
Radio instruments and apparatus—		
Total	277	+ 61
From United Kingdom	136	+ 43
,, Germany	13	+ 3
,, Holland	35	+ 12
,, United States	85	− 1
Other telegraph and telephone instruments—		
*Total	227	+ 18
Lighting accessories, fittings and switches—		
Total	343	+ 83
From United Kingdom	145	+ 55
,, Germany	33	+ 6
,, Japan	21	+ 11
,, United States	28	− 18
,, Hong-Kong	105	†
Batteries, dry—		
Total	434	+ 93
From United Kingdom	38	+ 35
,, United States	147	+ 17
,, Germany	11	+ 9
,, Hong-Kong	233	+ 29

	1937 Rs.(000)	Inc. or dec. on 1936 Rs.(000)
Other batteries and accumulators—		
*Total	484	+ 392
Electrical goods and apparatus not elsewhere specified—		
Total	426	+ 6
From United Kingdom	347	− 27
,, Germany	31	+ 19
,, Japan	11	+ 4
,, United States	22	+ 6
Transformers and convertors—		
*Total	56	+ 1
Generators and alternators—		
*Total	113	+ 18
Motors—		
Total	62	− 13
From United Kingdom	55	− 16
,, United States	7	+ 4
Electrical machinery not elsewhere specified—		
Total	154	− 69
From United Kingdom	112	− 54
,, Germany	20	+ 14
,, Italy	2	+ 1
,, United States	17	− 16

	1937 Rs.(000)	Inc. or dec. on 1936 Rs.(000)
Rubber insulated wires and cables—		
Total	224	+ 88
From United Kingdom	192	+ 76
,, Germany	21	+ 15
Other electric wires and cables—		
Total	461	+ 167
From United Kingdom	448	+ 160
,, Germany	6	+ 1
Lamps, gasfilled—		
Total	92	+ 15
From United Kingdom	79	+ 10
Electric lamps, other—		
Total	73	+ 16
From United Kingdom	49	+ 9
,, Japan	14	+ 8
Torch bulbs—		
Total	58	− 7
From Japan	24	− 6
,, United States	31	− 1

* Mainly from United Kingdom.
† Comparative figures not available.

The Electrical Situation in Australia

Sir Robert Dalton's report

IN his report to the Department of Overseas Trade on economic and commercial conditions in Australia (Stationery Office, 2s. 6d. net), Sir Robert W. Dalton, C.M.G., H.M. Senior Trade Commissioner in Australia, states that the year 1936-7 was one of the best that Australia has enjoyed for a long time. The United Kingdom's percentage share of total imports had declined from 41.5 per cent. in 1934-5 to 39.7 per cent. in 1935-6, but in 1936-7 it increased again to 41.9 per cent.

Dealing with imports in which the United Kingdom has to face severe competition, Sir Robert states that total imports of machinery continued to advance very considerably, the total for 1935-36 being £5,063,639. The share of the United Kingdom declined in 1935-36 (the latest figures available), as compared with 1934-5, which, although only 2 per cent., nevertheless represents an appreciable volume of trade. While imports from the United Kingdom in 1935-36 increased by 40 per cent. as compared with 1934-35, imports from the United States in this class advanced from £1,932,000 to £2,897,000, an increase of 50 per cent. The United States has increased her share in this class from 26 per cent. in 1933-4 to 29¼ per cent. in 1934-5, and to 30 per cent. in 1935-6. Imports from Germany in this class rose from £343,000 in 1934-5 to £604,000 in 1935-6. It was from these two countries, and to a lesser extent from Canada, that the main competition was felt by the United Kingdom in the following electrical items :—

	Total Imports.	From United Kingdom.	From Other Countries.	
	£	£	£	
Electric batteries, not specifically mentioned.	16,108	3,409	12,699	(U.S.A. £12,355).
Telegraph and telephone cable, paper insulated and lead covered.	20,154	3,918	16,236	(Germany £14,393).
Carbon manufactures of all kinds	58,743	16,552	42,191	(Germany £14,354, U.S.A. £13,741, Canada £10,771).
Electric motors under 1 h.p.	94,021	45,635	48,386	(U.S.A. £36,797).
H.V. ignition coils	9,145	2,518	6,627	(U.S.A. £5,792).
Alternators for steam or water-driven turbines.	40,247	16,164	24,083	(All Switzerland).
Electric fans	29,594	7,132	22,462	(U.S.A. £14,706).
Lightning arrestors, other than radio.	7,251	232	7,019	(U.S.A. £4,141, Germany £2,878).
Time switches, liquid slip regulators, etc.	20,518	8,080	12,438	(Germany £9,535).
Relays of various types ...	12,684	3,432	9,252	(U.S.A. £7,856).
Household electric dishwashing and ironing machines.	7,083	25	7,058	(U.S.A. £4,348, Canada £2,706).
Filament lamps for motor cars.	54,999	24,456	30,543	(Netherlands £26,385).
Filament lamps under 20 V.	25,229	9,839	15,390	(Netherlands £6,164, U.S.A. £3,116).
Electric vacuum tubes ...	13,340	1,426	11,914	(U.S.A. £9,238).
Radio valves	276,186	77,293	198,893	(U.S.A. £100,667, Netherlands £93,406).
Battery eliminators	2,210	368	1,842	(U.S.A. £1,811).
Radio parts, not specifically mentioned.	39,985	11,528	28,457	(U.S.A. £24,567).
Radio receivers	10,605	1,007	9,598	(N.Z. £4,089, U.S.A. £2,838).
Insulating tubes	9,472	4,342	5,130	(U.S.A. £4,215).
Coal-cutting machines, and parts.	20,367	7,677	12,690	(U.S.A. £12,638).

Imports of radio valves from the United Kingdom declined from £327,390 to £276,186, due to increased local production, but the United States and the Netherlands more than held their share of the slightly restricted market. Small increases in the United Kingdom's share of the trade are to be noticed in a few items, including electric motors (under 1 h.p.). Its share in the imports of filament lamps of all kinds increased, however, from 61 per cent. to 70 per cent.

The United Kingdom's share of the trade in items other than those "severely competitive" remained much the same as in 1934-5, being 78 per cent., as against 78¼ per cent. in the previous year. Many items in this class were placed in May, 1936, on the list of goods prohibited from importation into Australia from foreign countries except under licence, and it remains to be seen how far the United Kingdom's share has changed as a result of altered circumstances. The items in this class include electric dish-washing and ironing machines, vacuum tubes and refrigerators, in which the United Kingdom makes a poor showing. These specialised types of machinery are worthy of particular attention by United Kingdom manufacturers, if their competitive position in the machinery trade is to be maintained.

Broadcasting Developments

As regards national broadcasting services, plans have been prepared for a new transmitting plant to be erected to the west of Melbourne to displace the two existing medium-wave transmitters, and one short-wave transmitter. Similar action is being taken with regard to new stations at Sydney; a new national station has recently been opened at Adelaide; and a second station is to be erected at Hobart, to provide transmissions on alternative wavelengths from that city. According to the statement made by the Federal Treasurer in introducing the Budget for 1937-8, six additional national stations were provided during 1936-7, bringing the total to twenty-one. Apart from these national stations there are now eighty commercial broadcasting stations licensed, depending entirely on advertising for their revenue. The number of broadcast listeners' licences reached 1,000,000 before the end of 1937.

The State Electricity Commission of Victoria is planning an extensive hydro-electric scheme on the Kiewa River in the north-east of Victoria. The total estimated cost of the scheme is £6,136,000, and it will increase the installed capacity of the Commission by 104,000 kW. Legislation to provide necessary finance is under consideration by the Victorian Parliament. The New South Wales Government is also taking preliminary steps to launch a scheme of electrical development taking nine or ten years to complete and costing approximately twelve million pounds.

The Council of Scientific and Industrial Research completed its first ten years of operation in 1936, and the occasion was marked by the issue of an interesting non-technical brochure. In addition to giving a résumé of the establishment and divisions of work of the Council, the publication provided detailed accounts of work done in regard to plant life, entomology, weeds, animal health, soils, irrigation settlement problems, forest products, food preservation and transport, mining investigations, and radio research.

Illumination on a scale never before attempted in Great Britain will be an outstanding attraction of the Empire Exhibition, Glasgow, which is being opened by the King and Queen next Tuesday. Our pictures show the equipment for the lighting of the Paisley Road fountain being placed in position and a number of large twin projectors for floodlighting purposes

Electricity Supply in Tasmania

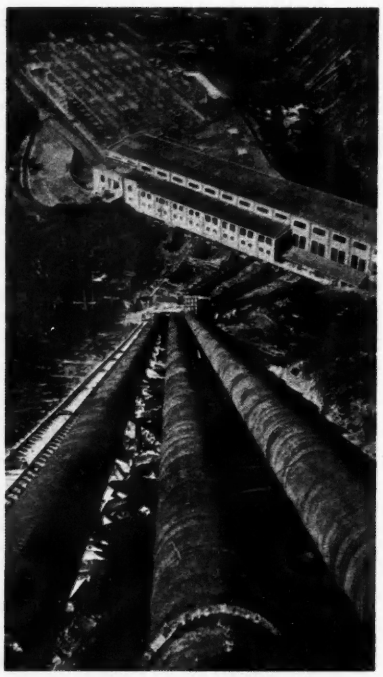
Recently the Governor-General started up the new Tarraleah plant which adds 45,000 kW to the power resources of the Hydro-Electric Commission

A MAJOR addition to the developed power resources of Tasmania was made on February 25th, when a 45,000-kW station of the Hydro-Electric Commission was officially opened by the Governor-General, Lord Gowrie. The new scheme increases the total generating capacity of the Commission from about 65,000 kW, installed in connection with the Great Lake and Shannon developments, to 110,000 kW, and the total from the Tasmanian rivers, including private plants, to some 12,000 kW, or less than 10 per cent. of the potential amount. During the year ended June 30th, 1937, the maximum demand was 58,000 kW with 463 million kWh generated (compared with 4 million in 1917) and the number of circuit miles of 110-kV and 88-kV lines was brought up to 527 and of lines between 2.2-kV and 44-kV to 910.

Water for the Tarraleah station is taken from the River Derwent, the source of which is Lake St. Clair, 2,300 ft. above sea level, with a sounded depth of 600 ft., only 25 ft. of which, providing a storage of 44,000 million gal., will be used for power. The scheme has involved the construction of a 380-ft. reinforced concrete dam across the river to control its flow, a pumping plant (comprising four 600 h.p. units) to maintain the flow when the level in the lake falls below the outlet of the discharge flume and a weir at the lake outlet to prevent pumped water from running back into the lake when the latter is at low level.

The controlled flow follows the natural channel of the River Derwent for 15 miles to a 500-ft. spillway weir, 30 ft. high, which diverts the water into the canal and flume system 12¼ miles in length, in which the fall is 66 ft., terminating in a storage basin measuring 900 by 200 ft. At a point nine miles below the intake works a deep gorge was negotiated by the construction of an inverted syphon.

Water from the storage basin is carried by a short length of canal to the forebay and there enters the main 102-in. diameter pipe line. At the forebay a spillway discharges surplus water into a channel leading to a creek. From the forebay the water is conveyed by three pipe lines (one per turbine) for nearly 1¾ miles to the power station at the bottom of the gorge. The discharge from the latter is into the Nive River, a tributary of the Derwent, which it joins seven miles lower down.



Looking down on the power station

The first installation consists of three 428-r.p.m., 21,000-h.p. Boving turbines, parts of which were manufactured in Australia by Thompson's Engineering & Pipe Works, Ltd., direct coupled to 18,750-kVA (0.8 p.f.) Brown-Boveri 11-kV, 50-cycle three-phase alternators, and ten 6,270-kVA oil-insulated self-cooled single-phase transformers (one spare) by A.S.E.A., Ltd., for raising the voltage to 110 kV, at which switching is carried out. The 110-kV oil circuit-breakers are of Brown-Boveri make and with the alternators were supplied by Gibson, Battle (Melbourne) Proprietary, Ltd.; the air-break isolating switches were manufactured by Essentee Switchgear, Ltd. (Sydney), and mounted on insulators obtained from Steatite & Porcelain Products, Ltd. A 50-ton overhead travelling crane with auxiliary 10-ton hoist has been supplied by Babcock & Wilcox, Ltd. Two further turbo-alternators will be installed at a later date.

Transmission from Tarraleah to Hobart is by means of a 110-kV overhead line, 57½ miles in length, carried by double-circuit galvanised steel towers except for the first eight miles, in which 100 separate-circuit towers of snow-proof design are used; the number of double-circuit towers is 303. There is also a single-circuit line to Rosebery, 75 miles distant. The towers were fabricated by Johns & Waygood, Ltd. (Melbourne), and Sidney Williams & Co., Ltd. (Sydney). At Hobart, Messrs. Gibson, Battle have installed three three-phase 38,000-kVA Brown-Boveri transformers for stepping down the voltage to 11 kV.

Indian Electrical Imports

A survey of the import trade of India during the first nine months of the fiscal year (April 1st to December 31st, 1937), prepared by H.M. Senior Trade Commissioner in India, shows that the aggregate trade in electrical instruments, apparatus, appliances and parts, expanded considerably from Rs.218 lakhs to Rs.254 lakhs. More than 50 per cent. of this trade is enjoyed by the United Kingdom, whose exports advanced from Rs.127 lakhs to Rs.133 lakhs. Other countries, notably Germany and Japan, also showed increases, but imports from the United States were practically stationary at Rs.28 lakhs. The total trade in electric fans and parts experienced a decline from Rs.26¼ lakhs to Rs.22 lakhs. The whole of this fall was suffered by the United Kingdom, whose shipments declined from Rs.19¾ lakhs to Rs.11¾ lakhs.

The import trade in electric wires and cables increased appreciably, from Rs.66¼ lakhs to Rs.86 lakhs. The bulk of this trade is in the hands of United Kingdom manufacturers, whose exports advanced from Rs.48.3 lakhs to Rs.61 lakhs. There was some expansion in the imports of telegraph and telephone instruments and apparatus, from Rs.14 lakhs to Rs.15½ lakhs. The imports from the United Kingdom, however, suffered a slight decline, from Rs.12.8 lakhs to Rs.11.2 lakhs.

In the imports of gas-filled electric lamps there was an increase from Rs.11.9 lakhs to Rs.14.5 lakhs. The arrivals from the United Kingdom showed little change, and registered Rs.8.4 lakhs, as compared with Rs.8.2 lakhs in the corresponding period of 1936. The imports of vacuum lamps increased by nearly 50 per cent. in value, from Rs.8¾ lakhs to Rs.12¾ lakhs. The first place has been secured by Japan, whose supplies advanced from Rs. 1.6 lakhs to Rs.3.7 lakhs, displacing the United Kingdom, whose arrivals declined slightly from Rs.3.9 lakhs to Rs.3.6 lakhs. There was also a sharp advance in the imports of electric lamps (other sorts), from Rs.7¼ lakhs to Rs.11 lakhs. This trade is distributed fairly evenly over the principal countries of supply, but there was a small decline in the United Kingdom's share from Rs.0.88 lakh to Rs.0.81 lakh.

The import trade in batteries showed a small increase, from Rs.19¾ lakhs to Rs.20¼ lakhs. Approximately 70 per cent. of this trade is enjoyed by the United States, whose exports, however, declined slightly from Rs.15½ lakhs to Rs.14¾ lakhs. In electric lighting accessories, including switches, there was an increase in the aggregate imports, from Rs.4.9 lakhs to Rs.6.4 lakhs. Although the arrivals from the United Kingdom showed a slight advance, from Rs.2½ lakhs to Rs.3 lakhs, those from Germany expanded by 100 per cent., from Rs.1.1 lakhs to Rs.2.2 lakhs. The trade in electricity meters was stationary at Rs.8.8 lakhs, although the share of the United Kingdom suffered a decline, from Rs.5.1 lakhs to Rs.4.1 lakhs. There was an increase in the imports of radio apparatus, most of which was due to a large expansion from the Netherlands (from Rs.2½ lakhs to Rs.7¼ lakhs). The total imports expanded from Rs.22.9 lakhs to Rs.30.3 lakhs, of which approximately 30 per cent. is respectively in the hands of the United States and the United Kingdom. The arrivals from the United Kingdom advanced from Rs.9 lakhs to Rs.9.8 lakhs. As regards complete receivers, the total imports increased from Rs.15 lakhs to Rs.19½ lakhs, of which the United States secured approximately Rs.8¼ lakhs in each of the two periods in question. The arrivals from the United Kingdom, however, increased from Rs.3.1 lakhs to Rs.5 lakhs.

Electrical machinery imports increased in value from Rs.178 lakhs to Rs.192 lakhs. A considerable percentage of this trade is enjoyed by the United Kingdom, whose exports, however, showed a small contraction, from Rs.127 lakhs to Rs.119 lakhs. The smaller shares of Germany and the United States rose from Rs.27½ lakhs to Rs.33.4 lakhs and from Rs.11.6 lakhs to Rs.11.7 lakhs, respectively. There was an appreciable advance in the imports from "other countries," from Rs.12.6 lakhs to Rs.28.3 lakhs.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

The Budget

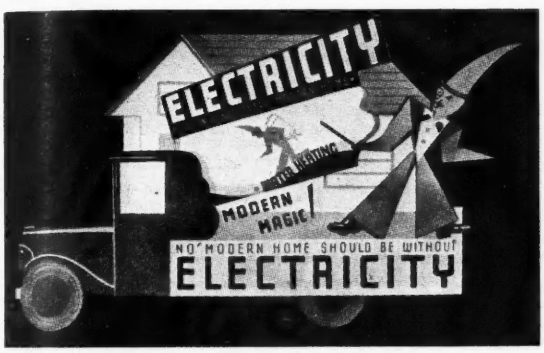
The principal feature of the Budget for 1938-39 opened by the Chancellor of the Exchequer (Sir John Simon) on Tuesday was an increase in the standard rate of income-tax from 5s. to 5s. 6d., with certain reliefs for small taxpayers. As a partial offset against this added burden the allowance in respect of wear and tear of machinery and plant is increased from 10 to 20 per cent. The tea duty is raised by 2d. per lb. and another 1d. per gallon is imposed on hydro-carbon oils (petrol and heavy oils used as fuel in road vehicles). An excise duty of 9d. per gallon is placed upon power methylated spirits. The Chancellor announced that certain measures would be introduced to repair loopholes in the income-tax law by which a great deal of revenue is lost. The total expenditure for 1938-39 (excluding self-supporting services) is estimated at £944,398,000 and the revenue at £944,750,000, giving an apparent surplus of £352,000.

"Cellophane"

In the article on "Sweet-making by Electricity" in our last issue reference was made in two or three places to "Cellophane"—which we spelt with a small "c." British Cellophane, Ltd., remind us that the word is not a generic term, but their registered trade mark.

E.D.A. Activities

The Sales and Publicity Programme of the British Electrical Development Association for May contains five poster stamps in colour, linking up with the current national campaign, which are now available for use on correspondence accounts, envelopes, &c. Particulars and prices are also given of five new posters (sixteen sheet and double crown), dealing with refrigeration, cooking, water heating and wiring (two posters). The E.D.A. poster handbook containing illustrations and details of the full range of thirty-seven posters is also available. The success of last year's carnival car has encouraged the Association to offer this attraction again. This year the display incorporates a "non-stop" procession of "I'm Electric" figures carrying into the modern home various electrical appliances. The charge is the same as last year (£10 per day).



An artist's impression of the E.D.A. carnival car for 1938

The Anglo-Irish Agreements

The agreements signed on Monday last by representatives of the British and Irish Governments, referred to in a leaderette, provide for the abolition of the import duies imposed by the Irish Free State (Special Duties) Act, 1932, and the Irish Customs (Emergency) Duties, as from a date to be agreed between the two Governments. One effect of this is that articles from this country which were formerly exempt from the payment of duty and quantitative regulation upon importation into Eire regain their former status (with the exception of payment of "package duty," which is to be limited in its operation). The goods concerned are set out in a schedule to the agreements (Schedule II, Part I); they include the following classes:—Electrical ware, including insulators, glazed; scientific glassware; copper blocks, strips, sheets, rods, &c.; scientific instruments and appliances; accumulators and parts (not for dutiable use); carbon rods for street and cinema arcs; insulated wires and cables of which any covering or sheathing is made of metal; telegraph and telephone instruments and apparatus; and wire for bulbs, tungsten wire and push buttons for electric stands.

Article 17, which deals with the importation of "complete or substantially complete aggregates of parts" for motor vehicles, provides for the removal of quantitative restrictions and their importation at the rates of duty known as "compounded duties." It is noted, however, that on the removal of the restrictions from electric filament lamps, under this provision, such lamps may be subjected to higher duties than the compounded duties.

Employment in March

Employment in the engineering industry in March showed little general change and was good on the whole. It declined slightly in electrical engineering but was still very good. According to the *Ministry of Labour Gazette* the number of unemployed in the engineering industry was 77,622, or 6.6 per cent., a decrease of 0.1 per cent., as compared with February, but an increase of 1.2 per cent. as compared with March, 1937. In the electrical engineering industry the unemployed totalled 5,559, or 4.8 per cent. (4.6 per cent. in February and 3.3 per cent. in March, 1937). The unemployed in the electrical wiring and contracting industry totalled 4,421, the percentage rising slightly to 10.7 (9.9 per cent. in March, 1937). In the cables, apparatus, lamps, &c., group the unemployed numbered 16,425, the percentage falling from 9.3 to 9.2 (5.7 per cent., in March, 1937).

Vacuum Cleaner Acquisition

Thorn Electrical Industries, Ltd., has extended its manufacturing activities by entering the electric cleaner and washer field. A new subsidiary company, British Electric Domestic Appliances (1938), Ltd., has been formed to take over the assets of British Electric Domestic Appliances, Ltd., makers of, *inter alia*, "Mary Ann" and "Bedalax" electric cleaners, and "Bedal" electric washing machines of various types. Special attention is being paid to the development of the new "Bedal" upright cleaner with external vacuum bag. Mr. S. F. Sheridan, late managing director of the old company, will be connected with the new concern. To secure extended sales a national advertising scheme is being commenced.

Recreation in Industry

The Industrial Welfare Society has prepared a booklet entitled "Recreations in Industry" for the use of its member firms who are anxious to promote indoor and outdoor recreation clubs for their employés. The subject matter of the booklet applies, however, equally to all those who in any way are attempting to organise leisure pursuits in clubs, evening institutes, community centres, churches or other bodies in urban or rural areas. In each chapter and section reference is given to the main national and local organisations, to suppliers of material and to books and periodicals. Copies of the booklet can be obtained from the Society at 14, Hobart Place, Westminster, S.W.1 (single copies 1s. 2d., post free, and for quantities of twenty-five and over, 10d. each).

Latvian Foreign Trade

The foreign trade of Latvia in 1936 and 1937 showed considerable expansion and an export surplus was achieved in both years. In his report to the Department of Overseas Trade on the economic and commercial conditions in Latvia (Stationery Office, 1s. net), Mr. H. A. Hobson, Commercial Secretary to H.M. Legation at Riga, states that as a result of the Anglo-Latvian Commercial Agreement, which has been in operation in the period under review, the volume of goods obtained from the United Kingdom has increased, but their proportion to the total Latvian imports has remained practically unchanged. An appendix to the report gives the principal imports into Latvia. This shows that the value of electric motors and dynamos imported amounted to 426,000 lats in 1935, 596,000 lats in 1936 and 659,000 lats in 1937. The construction of the hydro-electric plant at Kegums is stated to be proceeding normally. The requisite machinery, equipment, metals and tools are being purchased chiefly in Sweden, Germany and Switzerland, and only a few comparatively small orders went to the United Kingdom.

A Refrigeration Conference

A sales conference of the London and Home Counties representatives of the Lightfoot Refrigeration Co., Ltd., was held last week at the Holborn Restaurant. It was opened on Thursday morning by Mr. V. A. Mattick, who described the manufacture of the refrigerators in the U.S.A. Mr. Hughes (assistant sales manager) referred to the "kitchen-proving" of Westinghouse refrigerators. Over 100 housewives in various parts of the world, including tropical countries, had been asked to test the refrigerators. The results were obtained from families spending about £9 per month, four in family with a refrigerator averaging 6 cu. ft. in size. The average kitchen temperature was 75 deg. F., the door being opened 46 times a day (average) and 1.7 ice trays were made daily. The average daily consumption per refrigerator was 0.8 kWh, and the compressor was working only 15½ per cent. of the day. The average time taken for ice making was 45 min., while the housewives claimed that the refrigerator made a saving of about 4s. 6d. per week through buying in bulk. Mr. Hughes said that the company did not think it worth while introducing a 2 cu. ft. size. He then went on to detail methods of selling, such as cold cookery demonstrations, films, direct mailing and local advertising, a subject which was dealt with more fully in the afternoon by Mr. S. Wildman. During the

luncheon Mr. K. Lightfoot, the chairman, mentioned that a large proportion of the goods obtained from Australia were kept in condition by Lightfoot units; additional equipment had been installed at Wall's ice-cream factory at Acton. Mr. V. W. Dale gave details of E.D.A.'s refrigeration campaign, stating that they had already sold a thousand refrigeration window displays, and the number of coupons received from E.D.A. advertisements had exceeded the most optimistic estimates. It was estimated that there were 200,000 refrigerators connected in this country.

During the afternoon Mr. K. A. Aldridge (assistant sales manager) introduced the washing-up machine, which is an entirely new departure for the company. Subsequently Mr. S. E. Arridge concluded the main business of the meeting with an address on the domestic appliance market, and mentioned that some interesting developments would shortly be made with regard to electric irons. A new fish cabinet was also introduced.

Electrical Exhibition in Switzerland

Work has already begun on the electrical section of the Swiss National Exhibition to be staged in Zurich next year. A diorama series will illustrate power transmission plants of the country. Methods of applying electricity to heating and lighting in general industry and in the hotel trade will be shown on special stands, and a model electrified railway station and electric locomotive will be on view.

Orders Recently Booked

Among the orders recently received by Bastian & Allen, Ltd., is a 650-kW electrode boiler for the central heating of the Stalybridge offices of the Hyde, Mossley and Dukinfield Electricity Board. Other orders include a complete electric thermal storage central heating system with immersion heaters, totalling 150 kW for the new Wandsworth offices of the County of London Electric Supply Co., Ltd., a 175-kW electrode steam boiler plant for John Scott, Ltd., Glasgow, and a central heating plant with electrode circulator rated at 100 kW for the Belmos Co., Bellshill.

F. Reid, Ferens & Co., Ltd., have obtained the contract for the electric-discharge street lighting in Helmington Row, Co. Durham.

Lamp Production in the Dutch East Indies

It is announced from Batavia that the recent removal of the import restrictions on wire filaments has permitted the starting of a new Chinese works for the production of electric lamps in Cheribon. Besides these two factories there is a third lamp works at Soerabaya. The restrictions on the imports of complete lamps were extended in January for one year.

American Electric Clock Exports

There was a big increase last year in the overseas demand for American electric clocks, no fewer than 196,538, valued at £87,313, being exported, as compared with 114,159, valued at £59,907, in 1936.

Social Events

The annual dinner of the British Institute of Engineering Technology, the British Tutorial Institute and the British Institute of Sales Promotion, was held on April 21st at the Café Royal, London, Mr. D. B. Drake presiding. In proposing the toast of "The British Institutes," Mr. P. W. Wilkins said that the gathering was the largest of its kind and was a clear indication of the progress which had been made. Mr. Drake, in responding, said that the past year had provided records in the number of enrolments and successes. He referred to the extension of their activities and mentioned that they now had branches in South Africa, Australia, India, Canada and the Near East. Their success had been largely due to the loyalty of the staff.

Henley's staff at Holborn Viaduct are having a busy time socially this week. On Monday the Henletel Golfing Society held a meeting at Dulwich and Sydenham Hill Golf Club and played off the first round of the Sir Montague Hughman challenge cup. The results were: Mr. Vidler beat Mr. Oswald 5 and 3; Mr. McClelland beat Mr. Cooper 2 and 1; Mr. Lishman beat Mr. Jacob 3 and 1; Mr. Mason beat Sir Edward Crowe 3 and 2; Mr. Petrie beat Mr. Bradfield 3 and 1; Mr. Wilkins beat Mr. Rhodes 8 and 6; Mr. Melhuish beat Mr. Bunting 5 and 4. On Tuesday evening the first rounds of the Head Office spelling bee were held in the Social Club Room at Holborn Viaduct; and to-morrow (Saturday) a team from the Henletel Bowling Club will journey to Gravesend to combine with Gravesend Works, Woolwich Works, Research and Tyre Co. in a contest against local bowls clubs on the Gravesend Sports Club's new bowling green. Other members of the Henletel Bowling Club will open the season on the Finsbury Circus greens of the City of London Bowling Club.

Advertisement Correction

Messrs. B. H. Ries, Ltd., ask us to state that they inadvertently termed their No. 419 desk clock an alarm clock in their advertisement in our last issue (Supplement p. 25).

Change of Address

The offices of the Manchester Corporation Electricity Department will be at the new Town Hall, Manchester, 2, as from May 2nd.

Morley Electrical Exhibition

An electrical exhibition was held recently by the Morley Corporation Electricity Department in conjunction with the Electrical Distribution of Yorkshire, Ltd. (which supplies electricity in the Council's added areas) at the Town Hall, Morley. Many well-known manufacturers co-operated to give a representative display of electrical appliances for the home, while the Electricity Department, in addition to a stand showing

The demonstration stand of the Morley Electricity Department at the recent electrical exhibition

various electrical appliances arranged a series of stage demonstrations. At the closing ceremony of the exhibition it was announced that it had been visited by 6,000 people with gratifying results. Mr. W. B. Woodhouse (managing director of the Electrical Distribution of Yorkshire, Ltd.), in congratulating the organisers of the exhibition and Mr. N. Hunter, the borough electrical engineer, expressed the hope that now the residents knew a little more about the domestic uses of electricity, progress would be at an even faster rate.

Wireless Equipment for Liners

The Union Castle Mail Steamship Co., Ltd., have given the Marconi Company an order for the supply and maintenance of complete wireless apparatus for their new passenger ship *Capetown Castle*. The *Arundel Castle* and the *Windsor Castle*, which were recently refitted, were also newly equipped with Marconi wireless apparatus. Orders have also been received by the company for supply of wireless apparatus to the *Carnarvon Castle*, *Winchester Castle* and *Warwick Castle* after their alterations which are scheduled to take place this year. The equipment of the *Capetown Castle* (similar to that fitted or to be fitted on the other vessels), which will enable communication to be maintained at all times with any part of the world, consists of a Marconi radio-telegraph installation including a 2-kW c.w./i.c.w. transmitter for long and medium wavelengths, a 1½-kW short-wave transmitter, and a ½-kW quenched spark gap emergency set, together with receivers covering the whole of the commercial wavelengths. This apparatus not only ensures compliance with the Safety of Life at Sea Regulations, but also provides the ship with a service which will enable her passengers and personnel to be in communication with various countries of the world throughout the voyage between England and South Africa. For navigational purposes and to comply with Government regulations a Marconi direction finder with double loop fixed frame aerial is being installed. Two motor lifeboats are also being fitted with wireless transmitters and receivers.

Trade Announcement

Mr. R. B. Whittick, A.M.I.E.E., agent for G. P. Dennis, Ltd., G. H. Carter & Sons and Critchley Bros., has changed his address to 3, Bloomsbury Place, Southampton Row, W.C.1 (telephone: Museum 5853-4).

Winding Plant for Mines

Among the well-known winding engine manufacturers in this country, it is believed that only the General Electric Co., Ltd., produces in its own factories both steam and electric winding plant. This company's Fraser & Chalmers Erith works manufacture complete steam winders and the mechanical parts of electric winders, while electric motors and control gear are made at Witton works, Birmingham. Geared and direct-driven winding plants of all sizes have been shipped to colliery and mining undertakings in all parts of the world, and examples are at work in many collieries in Great Britain. An outline of the main schemes employed in modern practice is given in a recently issued Bulletin No. 17, "G.E.C.-Fraser & Chalmers Steam and Electric Winding Plant," copies of which can be obtained from the G.E.C., Magnet House, Kingsway, London, W.C.2.

Contractors' Liability for Damages

In our issue of March 11th (p. 360) we reported that Mr. Justice Hawke had reserved his judgment in an action brought by Mr. A. H. Bigny against the Corporation of the City of London (E. H. Wheeler & Co., Ltd., third parties). Mr. Bigny, an electrician, had sustained injuries while working at the Central Criminal Court as an employé of Messrs. Wheeler. The Corporation had agreed to pay him £1,500 damages and £105 costs but claimed to be indemnified by Messrs. Wheeler.

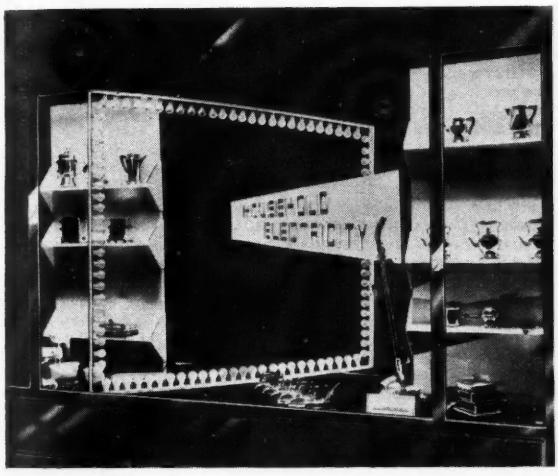
The latter had taken over the electrical installation work from the original contractors, who had failed to complete it in the specified time, but no formal contract had been entered into with the Corporation. In those circumstances Messrs. Wheeler, while admitting that most of the conditions of the original contract could be implied into the new or interim contract, claimed that the one as to indemnification could not. They further contended that the Corporation should not have compromised the claim with Mr. Bigny.

Giving judgment on Tuesday last Mr. Justice Hawke held that Messrs. Wheelers were bound in the circumstances by the terms and conditions contained in the contract entered into between the City Corporation and the original electrical contractors and that they were under a liability to indemnify the Corporation against the damages and costs which the Corporation had paid to Mr. Bigny. The settlement arrived at was a reasonable one in the circumstances and he granted a declaration that the Corporation was entitled to be indemnified by Messrs. Wheelers against the damages and costs paid to Mr. Bigny.

It was announced that there might be an appeal from his Lordship's judgment.

A Demonstration Shop Window

The accompanying illustration depicts a special display of electrical equipment arranged by the Reinmann School in the demonstration shop window of Holophane, Ltd. The electrical equipment was lent by L. G. Hawkins & Co., and was arranged by students for lighting in white and amber from Holophane "Controlens" plates, arranged in the roof of the window. Special changing colour lighting from motor-driven dimmers



An electrical equipment display in the demonstration shop window of Holophane, Ltd.

was arranged for lighting from the top and two sides. The central display, consisting of an outline of pearl lamps, with the sign "Household Electricity" suspended by two invisible wires, stood out in bold relief against the matt black velvet background. One of the novel effects was the changing of the coloured letters from the rest of the sign.

Prices of Materials

Henry Gardner & Co., Ltd., report, April 27th: Copper bars (best selected), sheet and rod, no change. English pig lead, £17 5s., 10s. decrease. Spelter, £13 12s. 6d., 5s. decrease. English block tin, £164 15s., £6 5s. decrease. Mercury, £12, 10s. decrease.

Frederick Smith & Co. report, April 27th: Electrolytic copper bars, £44 10s., 15s. increase. Ditto, ditto, wire rods, £49, 15s. increase. Ditto, ditto, h.c. wire, 7¾d., $\frac{1}{16}$d. increase. Silicum bronze wire, 8¾d., $\frac{1}{16}$d. increase.

Edward Till & Co. report, April 27th: India rubber, Para fine, no change.

New Catalogues and Lists

British Aluminium Co., Ltd., Adelaide House, King William Street, London, E.C.4.—Booklets on "Aluminium Sheet Metal Work" and "Aluminium Machine Bar Stock."

Crofts (Engineers), Ltd., Thornbury, Bradford.—A selection of leaflets dealing with friction clutches, belting, gears, guards, safety collars, &c., which may be used to safeguard workpeople and conform with the new factory regulations.

Keighley Gear Co., Prospect Works, Lockwood, Huddersfield.—A leaflet appertaining to the "2-three" type worm reducer.

Alkium Storage Batteries, Ltd., Waterside Works, Halifax.—A booklet describing the installation of batteries for air raid shelters.

A.C.E.C., 56, Victoria Street, London, S.W.1.—A quarterly stock list for April and a leaflet illustrating a 50,000-kW turbo-alternator.

J. Toubkin, Faraday House, Toad Street, Manchester, 3.—Details of the "Blackstone" washing machine.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, London, W.C.2.—A 20-page illustrated catalogue of "Supreme" domestic electrical appliances, including fires and "Sun-ray" apparatus. Also a leaflet describing the "Supreme" electric washer.

W. Watts, 44, Wisteria Road, Lewisham, London, S.E.13.—A leaflet illustrating "Writelite" desk and table lamps.

Price & Belsham, Ltd., Tamworth Lane Works, Mitcham.—A pamphlet (No. I. 112), describing a low-range portable maximum load indicator.

British Klöckner Switchgear, Ltd., 21, Birkin Street, Wandsworth Road, London, S.W.8.—A leaflet dealing with push-button power switches for straight-on starting.

Bankruptcy Proceedings

A. Johnson, 9, Ramsay Crescent, York Road, Doncaster, formerly 39, St. James Street, Doncaster, wireless dealer.—At the first meeting of creditors held on April 22nd at the Official Receiver's Office, 55, Queen Street, Sheffield, debtor attributed his present position to competition and insufficient turnover to provide for expenses and a living. According to the statement of affairs there were unsecured liabilities of £176 and a deficiency amounting to £173. The matter was left with the Official Receiver.

F. G. T. Lane, radio dealer, 101, Crouch Street, Colchester.—Receiving order made April 20th on debtor's own petition.

A. T. White, electrical engineer, Radio House, High Street, Hadlow.—Trustee, Mr. A. E. Orbell, 6 and 7, Old Steine, Brighton, appointed April 14th.

E. A. V. Burton, electrical engineer, 14, St. Peter's Park Road, Broadstairs.—Trustee, Mr. F. C. Wells, 1, The Parade, Canterbury, Official Receiver, released April 8th.

G. W. Jump, electrical engineer, 143, Sussex Road, Southport.—First and final dividend of 1s. 3d. in the £, payable April 27th at Government Buildings, Victoria Street, Liverpool.

A. M. Gibson and **W. R. F. Gibson,** radio specialists, 94, Tavistock Road, Plymouth, and at Exmouth and Teignmouth (separate estate of W. R. F. Gibson).—Supplemental dividend of 5s. 3d. in the £, payable April 27th at 11, St. Aubyn Street, Devonport, Plymouth.

Company Liquidations

Home Radio & Television, Ltd., radio engineers, 376, Brigstock Road, Thornton Heath.—The statutory meeting of the creditors was held recently, when it was reported that the liabilities amounted to £435. The net assets were £23, leaving a deficiency, as regarded the creditors, of £462. In addition to the liabilities shown there were contingent claims on hire-purchase agreements, the exact amount of which had not yet been ascertained. The shareholders had previously met and passed the usual resolution, putting the company into voluntary liquidation with Mr. P. L. Smout, of 131-4, New Bond Street, London, W.1, as liquidator. The meeting terminated without any definite resolution being passed and the voluntary liquidation of the company will, therefore, be continued with Mr. Smout as liquidator.

Resistance Microphones, Ltd., 97, Buckingham Palace Road, London, S.W.1.—At the statutory meeting of creditors it was reported that the liabilities to the trade were £175. It was estimated that the net assets would be £120. Resolutions were passed confirming the voluntary liquidation of the company, and it was intimated that an offer would be submitted.

Private Arrangements

E. C. Brown, trading as Brown's Radio Services, Chilwell, Notts.—At a recent meeting of the creditors it was reported that the liabilities to the trade amounted to £300, and there were cash creditors for £184, including £150 due to the debtor's wife. In addition the bankers were partly secured creditors for £796, and as security they held a charge on a house which was valued at £510. The total assets were £99. It was decided that the matter should be left in the hands of Mr. R. A. Page to realise the assets to the best advantage and distribute the proceeds *pro rata* amongst the creditors. It was stated that the claim of the debtor's wife for £150 would be withdrawn.

F. King and **G. W. Jobling,** trading as Newton Radio and Electrical Service Co., 22-24, Commercial Buildings, Dunston-on-Tyne, and 22, Church Street, Blaydon-on-Tyne, radio engineers.—The creditors met recently at Newcastle-on-Tyne, when the statement of affairs disclosed liabilities of £186, whilst the assets were estimated to realise £192, leaving a surplus of £6. In order to protect the assets a deed of assignment had been executed to Mr. F. Jackson, of 19, Saville Row, Newcastle-on-Tyne. The debtors put forward an offer to contribute 5s. per week each towards a fund to make good any deficiency in the assets. The creditors decided to confirm the deed of assignment already executed to Mr. Jackson, subject to the offer made by the debtors being carried out.

G. Cooke, deceased, trading as George Cooke & Co., electrical engineers, Station Road, Wilmslow.—At the recent meeting of the creditors a statement of affairs was submitted showing ranking liabilities of £1,595, of which £1,295 was due to the trade and £300 to a cash creditor. There were also fully secured creditors for £576. The net assets were £528, leaving a deficiency of £1,067. The estate showed an apparent dividend of 6s. 7d. in the £, subject to the costs of realisation. It was stated that the debtor died in August last and he left a will appointing his wife as sole executrix. The business had been continued since the death of the debtor. It was decided that the widow should take out probate and act under the directions of a committee in the distribution of the estate.

Electricity Supply

Lighting, Domestic, Power

Alford (Aberdeen).—Proposed Supply.—Work has begun on the erection of overhead lines to provide a supply of electricity to the village.

Alloa.—Change-over.—The Scottish Central Electric Power Co. has applied for consent to change the supply from d.c. to a.c.

Basingstoke.—New Feeder.—The Town Council is to apply for sanction to a loan of £4,690 for a new extra-high-voltage underground feeder from the electricity works to the existing Sherborne overhead line, and for the provision of two new sub-stations with low-voltage mains, to enable an a.c. supply to be provided for the South View district. The Council is also to provide for additional a.c. sub-station equipment at the works of John I. Thornycroft & Co., Ltd.

Bath.—Electric Heating Preferred.—The Council has decided to install electric heating in 500 council houses despite a letter from the local gas company asking for the matter to be reconsidered. It was stated that while electric heating might be more expensive in first cost, the gas company admitted that the gas heaters would have to be taken down and overhauled every six months, so that the maintenance charge would be high.

Berwick.—Electricity Cheaper.—As from the beginning of April the quarterly charge of the Scottish Southern Electricity Supply Co., Ltd., is reduced from 7½d. to 7d. per kWh, and the prepayment rate from 8½d. to 8d. per kWh.

Bexhill.—Off-peak Water Heating.—The Electricity Committee recommends a special off-peak tariff of 0.4d. per kWh for water heating in cases where the apparatus installed is not less than 10 kW.

Brighton.—Wiring.—The Elm Grove Home is to be rewired at a cost of £400.

Power Station Cooling System.—The Electricity Committee is to complete works at the cooling pond in connection with the augmentation of the circulating water system at Southwick power station, the cost being £14,000.

Chester.—Better Lighting.—The Watch Committee proposes to improve the lighting in Parkgate Road and Christleton Road at a cost of £1,022.

Extension.—The Electricity Committee is to extend its mains to Queen's Park and provide a transformer kiosk at a cost of £1,699 to meet the supply to War Office buildings, &c. It is also to provide additional lines from Waverton to Brassey Green to improve the supply to the Tarporley district at a cost of £8,540. Application is being made for permission to borrow £25,000 for mains and services.

Clitheroe.—Supply to Farms.—Supplies of electricity are to be given to six farms between Sawley and Stirk House.

New lighting by luminescent discharge lamps at Northgate, Halifax

Croydon.—Change-over.—The Electricity Committee is to change over the supply in the Crown Hill area to a.c. at a cost of £1,180.

Supply Extensions.—In connection with the development of the First National Housing Trust estate, Addington, the County of London Electric Supply Co., Ltd., has arranged to supply electricity to a further 475 houses at a cost of £9,300.

Dover.—Castle Floodlighting.—The new floodlighting at Dover Castle, in which mercury electric-discharge lamps are used, was put into operation for the first time at Easter. The scheme was carried out in co-operation with British Thomson-Houston & Co., Ltd.

Dumfries-shire.—Supply Developments.—Mr. W. M. B. Macdonald, reporting the progress of the electricity undertaking to Dumfries County Council recently, said that the output last quarter showed an increase of 10.6 per cent. over the corresponding quarter of last year. There were now 597 farms connected, of which over 200 were using electric motors. A number of additional power consumers had changed over to the Council's supply. They would shortly be erecting a new 33-kV line from Gretna to Lockerbie.

Durham.—School Installations.—The Board of Education has approved schemes submitted by the County Education Committee for electrical installations at the Easington Colliery, High Clarence and Bishop Auckland Girls' County schools.

Ealing.—Points for Refrigerators Free.—The borough electrical engineer having reported that in certain instances difficulties had been experienced in the installation of electric refrigerators under the present arrangements, the Electricity Committee has agreed that refrigerators purchased from the undertaking shall be installed and connected to a convenient point, to be provided if necessary, without cost to the purchaser.

Ring Main.—The Electricity Commissioners have sanctioned the expenditure of £25,000 in connection with the extension of the 11,000-V ring main for the north-western area.

Essex.—Supply to Sanatorium.—Consideration has been given by the County Health Committee to a report of the architect from which it appears that the County of London Electric Supply Co. is prepared to extend its mains to the Broomfield Court Sanatorium free of charge. The County Council has agreed to guarantee a minimum revenue of £200 per annum for three years.

Eton.—Sub-station.—The Slough & Datchet Electric Supply Co., Ltd., is to erect a sub-station at Boveney.

Cables.—The Urban District Council has approved plans submitted by the company for the laying of cables to Eton Wick and Boveney.

Fleetwood.—Increased Charges.—A 5 per cent. increase in electricity charges has been recommended by the General Purposes Committee on account of the higher cost of coal and wages. Twelve months ago the charges were reduced by 5 per cent.

Fort William.—Owing to the rejection of the Caledonian Power Bill, the Council has had to fall back on its original plans for the taking over of the electricity supply of the burgh, and the matter has been remitted to the Electric Light Committee to consider the details of the scheme.

Gravesend.—New Equipment.—Two switchgear units are to be provided at the generating station, and two more at Rosherville sub-station and one at "El Teb" sub-station, at a cost of £2,650. Mains extensions to assist "El Teb" sub-station and from Rosherville to Leather Bottel kiosk call for a further expenditure of £1,700.

Grimsby.—Power Station at Institution.—A recommendation has been passed by the Health Committee for an expenditure of £15,000 for building a section of a permanent power house and the installation of a part of the permanent plant at the Harmston Hall Colony.

Halifax.—Improved Lighting.—Part of the new public street lighting recently brought into operation in Halifax is shown in the accompanying photograph which we have received from Mr. G. A. Vowles, the borough electrical engineer and manager. The scheme covers a stretch of road extending from Union Street to New Bank and Haley Hill, and consists of nineteen 250-W mercury discharge lamps and a similar number of 400-W discharge lamps. The 400-W lamps have been installed along the shopping route extending from Union Street to Cross Hills and are of the luminescent type, and the scheme has been carried out as far as possible in accordance with the specification of the Minister of Transport's Departmental Committee on Street Lighting.

Hamilton.—Loan.—The Town Council has agreed to borrow £80,000 for capital works, including £19,000 for extensions of mains.

Harwich.—Transformers.—Application is to be made by the Town Council for sanction to a loan of £376 for two transformers.

Hove.—Mains and Services.—Sanction has been received by the Town Council to a loan of £21,000 for mains and services.

Hull.—Electricity for Fair Ground.—At a recent meeting of the Electricity Committee the engineer reported that he had investigated the possibility of giving a complete supply of electricity to all the stallholders on the fairground. The Markets Committee was extremely anxious that a supply of electricity should be made available, in order that the use of petrol wagons may be prohibited, thus lessening the fire risk to the public. It appeared that a sufficient revenue could be obtained, and he had agreed to provide the supply.

India.—Malakand Scheme Inaugurated.—The first stage of the Malakand hydro-electric scheme was opened by the Viceroy last Saturday. The power station is situated near the Malakand Pass, North West Frontier, and water is obtained from the Swat River. The scheme is designed to provide cheap electrical energy in the Peshawar Valley and to be capable of extension to cater for the Kohat and Hazara districts. Special towers have had to be designed for crossings over the Kabul River at Nowshera and over the branches of the Kabul and Swat Rivers between Charsadda and Peshawar. According to the Peshawar correspondent of *The Times*, the presence of good copper wire on these towers during the later stages of

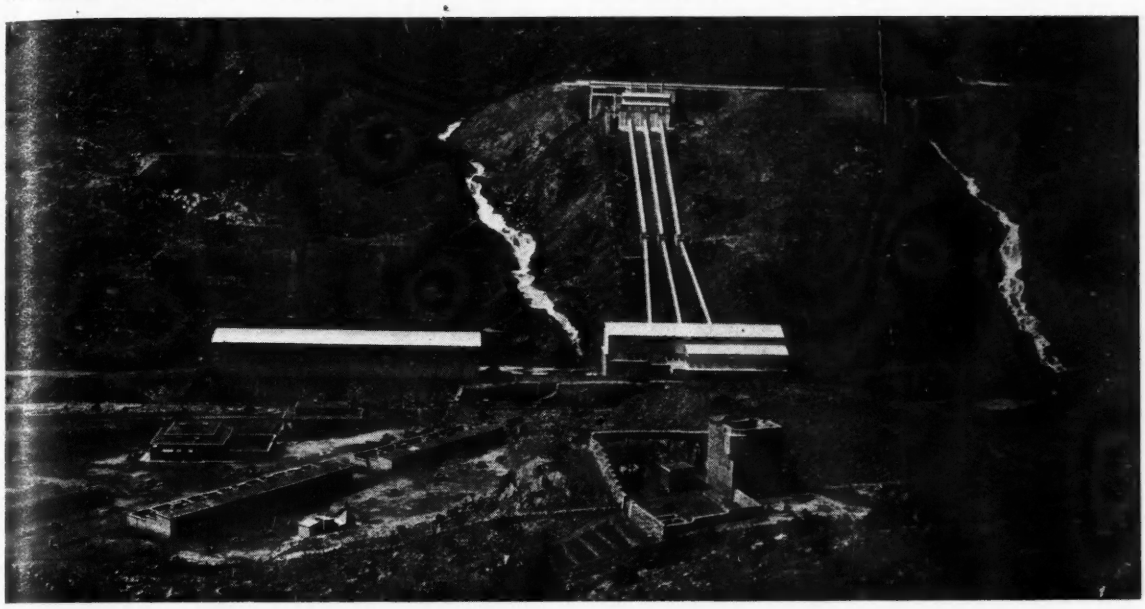
construction proved an irresistible attraction to the local tribesmen through whose territory it passes, and it was only by a partial energisation of the lines that their depredations could be curbed.

Kidderminster.—SUB-STATION.—The Shropshire, Worcestershire and Staffordshire Electric Power Co. is to erect a sub-station in St. John's Road.

Lincoln.—LOAN.—The Electricity Department is seeking sanction to borrow £30,000 for mains and services.

Malton.—OVERHEAD LINES.—The Rural District Council has approved plans submitted by the city electrical engineer of York showing the route of an overhead line proposed to be erected in Barton-le-Willows.

Manchester.—TRANSMISSION LINE.—The transmission line from Barton is being extended from the Oldham Road sub-station to the Greenwood Street sub-station at a cost of £8,500, in order to meet the existing and future demands for electricity in the city area.



The Malakand (India) hydro-electric scheme, showing the pipe-line leading from the valve house to the power house with a head of 250 ft.

London.—BATTERSEA.—The Electricity Committee is to replace the remaining vulcanised bitumen distributors at a cost of £39,500.

HACKNEY.—It is proposed to provide air-conditioning plant at the electricity showrooms and at the meter room. The Electricity Committee was informed that numerous complaints had been received of the heat and vitiated condition of the atmosphere in the showrooms in warm weather, while at the meter room it was essential that steps should be taken to prevent the appreciable deposit of dust and soot having regard to the important nature of the work carried out. The quotations recommended for acceptance (showrooms, £2,238; meter room, £996) were submitted by Utilities (London), Ltd. An additional expenditure of £1,200 is involved in connection with the installation of the apparatus.

HAMMERSMITH.—Consideration has been given by the Electricity Committee to the provision of a supply to 100 flats to be erected by the Council in the Becklow Place clearance area. It will be necessary to install a small sub-station on the site, lay high- and low-voltage cables, and install service mains. As in the case of the flats at Emlyn Gardens, provision will be made in each flat for electric cooking, heating and lighting supplies, in view of which a contribution of £310 is to be made towards the cost of the rising mains. The total estimated cost is £1,268.

STEPNEY.—A tender of £50,000 has been accepted by the Highways Committee for the reconstruction of the bridge over the entrance to London Docks, New Gravel Lane, Stepney. The new bridge, of the lifting type, will be electrically operated.

STOKE NEWINGTON.—Application is being made for permission to borrow £5,000 for electricity meters.

J.E.A.'s CHARGES.—The London and Home Counties Joint Electricity Authority is recommended by its Finance Committee to declare that, in the absence of specific directions by the Electricity Commissioners, it would not be justified in increasing its electricity charges at present.

Lowestoft.—ELECTRICITY FOR A BRIDGE.—The electrical engineer has been authorised to arrange for a supply of a.c. to be available for the operation of the new Mutford lock bridge.

METER TESTING.—The Council has approved an arrangement for the testing of meter by the Norwich City Corporation Electricity Department.

Macclesfield.—PURCHASE OF THE UNDERTAKING.—Special meetings of the Electricity and General Purposes Committees have authorised the town clerk to write to the Electricity Company of Macclesfield, Ltd., to inquire whether, in the event of the Corporation not giving immediate notice to purchase the undertaking, as it is entitled to do in August next, the company will agree to a postponement of the option for one or two years. The idea is that both the company and the Corporation will be in a better position to know definitely the Government's intentions after the proposed Bill has been introduced in Parliament, or an Act passed to deal with electricity distribution.

CHANGE-OVER.—The chief engineer is to make arrangements for a change-over from d.c. to a.c. in certain areas.

Middlesbrough.—SUB-STATION.—A sub-station is to be erected by the Town Council in Birchwood Avenue.

Morley (Yorks).—EXTENSIONS.—We are informed by Mr. N. Hunter, the borough electrical engineer and manager, that the following extensions have been approved by the Electricity Committee:—A supply to Finsdale Quarry—11 kV extension involving a pole type transformer and switchgear, at an estimated cost of £250; and a supply to Cardigan Quarry—11 kV extension involving an overhead line, brick built sub-station and equipment, at an estimated cost of £2,000. In addition £10,000 is to be spent on unspecified mains and £5,000 on the change-over of domestic apparatus.

Norton.—OVERHEAD SUPPLY APPROVED.—Plans by the Buckrose Light & Power Co., Ltd., illustrating the route of overhead low-voltage lines proposed to be erected in Butterwick and Foxhole, have been approved by the Rural District Council.

Richmond (Surrey).—MAINS EXTENSIONS.—The Richmond Electric Light & Power Co., Ltd., is to carry out extension of mains in Mortlake Road and Forest Road; and from Mortlake Terrace to the corner of Gloucester Road; and to extend the mains in Petersham Road, from Sandy Lane to Myrtle Cottage.

Richmond (Yorks).—PREPAYMENT FLAT RATE.—The City Council has fixed a flat rate of 4d. per kWh for all consumers using prepayment meters.

Rothes.—INSTALLATIONS IN MUNICIPAL PROPERTIES.—The Town Council is to obtain estimates of the cost of installing electricity in Council houses and also for the lighting of the Council Chamber.

LOAN.—It is proposed to borrow £725 for the purpose of providing fittings for street lighting by electricity in the burgh.

Rugby.—SUB-STATION.—Plans have been approved for the erection of a sub-station in Lawford Road, for the Leicestershire and Warwickshire Electric Power Co.

Stirling.—LOAN.—The Town Council is borrowing £6,005 for buildings and plant at the sub-station in Drip Road, and £220 for the installation of a number of electrical appliances at a hospital laundry.

Stoke-on-Trent.—TRANSFORMER IMPROVEMENTS.—The size of the transformers at Norton is to be increased at an estimated cost of £450.

Swansea.—INCREASED SUPPLY.—The Electricity Committee is to provide an increased supply to Superheater Units, Ltd., at a cost of £1,891.

Sweden.—WATERFALLS BOARD'S FINANCES.—The balance sheet for 1937 of the Royal Swedish Board of Waterfalls shows an excess of earnings over expenditure, after provision for depreciation, of 21.38 million kr., of which 20½ million kr.

was derived from the power plants. This represents a yield of 5.45 per cent. on the average amount of capital placed at the disposal of the Department by the State during the year. In 1936 the surplus was 20.76 million kr., equivalent to 5.36 per cent.

A LONG HIGH-VOLTAGE LINE.—Junction has just been effected in Sweden between the Porjus water-power station in Lapland and the networks of Central and Southern Sweden and Lower Norrland, thus linking up the whole of the Swedish State power distribution system. So far the junction is merely provisional, the State for the present partially employing the line of the private power undertaking at Krangede, but it will definitely be established next year, when the trunk high-voltage line from Lapland to the steam reserve plant in Vasteras, Central Sweden, is completed. This line will be about 625 miles long. The new connection enables the Swedish Board of Waterfalls to utilise in Central and Southern Sweden the great surplus of electrical energy generated by the Porjus station, estimated at 150 million kWh. This is of particular value for the summer months, as the continual melting of snow in the far north maintains the requisite head of water, even in the driest seasons, while in the most southernly parts of the country it sometimes happens that power production is considerably reduced owing to a shortage of water.

Switzerland.—COMPRESSED AIR CIRCUIT-BREAKERS.—As the result of the explosion of an oil circuit-breaker at the principal electric power station in Winterthur, Switzerland, in 1936, it was decided to replace all the breakers with those of the compressed air type. According to Herr W. Howald in the Bulletin of the Swiss Association of Electrical Engineers, the new equipment comprises thirteen circuit-breakers and eight auto-pneumatic interruptors. The author expresses the opinion, however, that despite the numerous advantages of compressed air switches there is still a wide field for oil switches, for they are less costly than those of the compressed air type.

Wales.—SUPPLY TO STEELWORKS.—The 18½-mile transmission line from the Upper Boat power station of the South Wales Power Co. to the new Ebbw Vale steelworks has now been practically completed. The Central Electricity Board's sub-station at Upper Boat has been extended, and at Ebbw Vale a site of 2½ acres has been prepared for a new sub-station to accommodate three transformers with a capacity of 90,000 kW. In all 132 towers have been erected, the highest of which is 130 ft. Across the Sirhowy Valley there is a single span of 980 ft. The cost of the work exceeds £250,000.

Williton.—RURAL SUPPLIES.—No objection has been raised by the Rural District Council to the proposal of the Minehead Electricity Supply Co. to erect overhead lines to serve West and East Quantoxhead, Kiloe and Holford.

Wallasey.—REVISED CHARGES.—The following charges have been recommended by the Electricity Committee:—Domestic two-part tariff "unit" charge, 0.33d. per kWh throughout the year. Lighting (ordinary), up to 500 kWh per quarter, 2¾d. per kWh; from 500 to 1,000 kWh, 2½d. per kWh; 1,000 to 1,500 kWh, 2¼d. per kWh; and excess over 1,500 kWh 1¾d. per kWh. Lighting (prepayment meter), 3d. per kWh.

Wood Green.—ELECTRICAL EQUIPMENT.—The North Metropolitan Electric Power Supply Co. is to erect outdoor transformers and electrical gear on land at the rear of Torrington Gardens and Cline Road.

Traction

Newcastle-on-Tyne. — OPPOSITION TO TROLLEY-BUSES. — The Northern Area Traffic Commissioners, at a meeting last week, adjourned the hearing of an application to change the Denton Square bus service to trolley-buses. It was stated that the service was at present covered by the motor buses of United

A trolley-coach in service in the reconstructed Savadoe Ring, Moscow. The use of passenger trolley vehicles is being considerably extended in the capital, and they are also being applied to the transportation of goods

Automobile Services, who had reached an agreement to hand over the route to the Newcastle Corporation for operation by trolley-buses. Mr. R. Stokoe, representing 120 workers at Denton Burn, objected to the change on the grounds that with trolley-buses the journey would take longer, thus curtailing the dinner period of many workers. Sir John Maxwell (chairman of the Commissioners), adjourning the hearing, insisted that better lunch-hour arrangements should be made.

VISIT OF NORWEGIAN TRAMWAYS OFFICIALS.—Members of the Bergen Tramways Board and the Burgomaster of Bergen arrived at Newcastle-on-Tyne this week to begin a tour of the important transport undertakings in this country.

West Hartlepool.—TROLLEY-BUSES AND "NESCO."—The Town Council has agreed to the insertion of a clause in its Trolley Vehicles Provisional Order to protect the interests of the North-Eastern Electric Supply Co., Ltd.

TRACTION RECTIFIER PLANT.—The Town Council proposes providing additional rectifier plant in connection with the trolley-bus services.

Helping the Rates

ORIGINALLY the Sunderland Finance Committee budgeted for a rate increase of 3s. 6d. in the forthcoming year, but with the aid of £4,000 each from the electricity and transport undertakings and reductions of estimates by £30,185 this has been lowered to 2s. At Crewe a reduction of the street lighting rate by ¼d. per kWh and a revenue contribution of £1,800 represent aid from the electricity undertaking to the extent of about a 3d. rate and make possible an increase of only 4d. The Bredbury and Romiley Council is helped by its electricity undertaking, which is contributing £1,500, and at Lancaster £4,000 in addition to the £2,000 earmarked in last year's estimates is taken from the electricity profits. At Burton-on-Trent the Town Council decided that the Electricity Committee should consider making a grant of £7,140 towards the relief of the rates. The Committee has stated that it is not in a position to undertake the contribution this year.

An unusual situation has arisen at Stepney, where the sum of £26,200, transferred in aid of the general rate during 1935-36, is now to be refunded to the Electricity Committee. The decision for transfer was made on the assumption that certain expenditure to be incurred by the Electricity Committee would be made from money raised by loan, sanction to which was refused by the Electricity Commissioners, thereby necessitating the expenditure being made out of revenue. This would result in the reserve fund falling below the statutory minimum for a rate contribution to be made.

The Stafford Finance Committee is anticipating receiving a sum of nearly £2,000 from the Electricity Committee.

An item in this year's budget of the Preston Corporation is a contribution of £5,000 from the transport undertaking towards the relief of the rates. The Newcastle-upon-Tyne transport and electricity undertaking is to contribute £24,000 to the relief of rates, having during the past six years allocated £56,000 for this purpose. In a memorandum issued by the City Transport and Electricity Committee it is stated that repetition of the Estimates Advisory Committee's proposal in future years will seriously retard the completion of the work of changing over from tramcars to trolley-buses.

The action of the South Shields Town Council in transferring money from the surplus of the electricity undertaking to the relief of rates has resulted in a conflict with the Board of Inland Revenue, which contends that the Council should pay tax on the sum transferred to the general rate fund. The Council is to contest the claim. Mr. A. E. Gompertz, chairman of the Corporation Finance Committee, explained last week that the Board was challenging the Council's application for a set-off claim for the purposes of taxation when transferring the money. The borough treasurer (Mr. R. H. Coulthard) has recommended the Council to take the case to the High Court, pointing out that a private person who owns a number of businesses is permitted to set off for income tax purposes the losses sustained in one business against the profits of another.

As on previous occasions the Bolton Electricity Department is contributing £10,000 to the relief of rates. The Barrow-in-Furness Electricity Committee has transferred £1,500 from the profits of the undertaking for the current year. At Spenborough the £619 accepted from the electricity undertaking is the maximum amount permitted under the Act. The undertaking has, however, been assisted by the rates to the extent of £81,700. Owing to increased costs of generation it has not been found possible for the Electricity Department to aid the rates at Fleetwood, but Haslingden electricity undertaking is to contribute £1,000.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Abertillery.—May 7th. Electricity Department. Meter testing equipment. (April 15th.)
May 16th. Materials for twelve months. (See this issue.)

Australia.—MELBOURNE.—May 16th. City Council. Metal-clad switchgear for city sub-stations. (T.Y. 20797/38.)*

Barnoldswick.—May 14th. Electricity Department. Material and equipment for use on a 6.6-kV system. (See this issue.)

Bexhill.—May 3rd. Electricity Department. Materials for twelve months. (April 22nd.)

Birmingham.—May 7th. Education Committee. Electrical sundries for twelve months. Chief education officer, Council House, Margaret Street.
June 15th. General Purposes Committee. Complete electrical installation in a block of municipal offices now in course of erection. (See this issue.)

Blaydon-on-Tyne.—Blaydon, Ryton and Whickham Joint Hospital Committee. Electrical installation in the new hospital in course of erection at Blaydon. W. Crooks, architect, 26, Church Street.

Burnley.—May 16th. Electricity Department. Four 750-kVA transformers. (See this issue.)

Cheadle and Gatley.—May 16th. Electricity Department. One 250-kVA transformer. (See this issue.)

Chesterfield.—May 12th. Electricity Department. Cable. (See this issue.)

Coupar Angus (PERTHSHIRE).—April 30th. Town Council. Electric lighting installations for the Hillgarden and George Street housing estate. A. F. Laing, Town Clerk (deposit £1 1s.).

Croydon.—May 17th. Electricity Department. Stores and materials for twelve months. (See this issue.)

Enfield.—May 2nd. Enfield, Edmonton and Potters Bar Joint Hospital Board. Electrical installation at the Infectious Diseases Hospital, Winchmore Hill. (April 22nd.)

Fife.—May 2nd. County Council. Electric lighting of three houses at The Wynd, Dunshalt. County Clerk, County Buildings, Cupar (deposit £1 1s.).
May 7th. Works Department. Materials, including cables, conduits, flexes, lamps, shades and accessories, for twelve months. Medical superintendent, District Asylum, Cupar.

Galashiels.—Town Council. Electrical work in eight houses at Blynlee. J. and J. Hall, architects.

Glasgow.—May 9th. Electricity Department. Materials for twelve months. (April 22nd.)
May 3rd. Corporation. Electrical work at Knightswood Community Centre. Town Clerk (deposit £2 2s.).

Epsom.—May 16th. Electricity Department. P.i., lead-covered and double steel armoured l.v. cable. (See this issue.)

Halifax.—May 14th. Electricity Department. Fire extinguishing equipment for Highroad Well sub-station. (See this issue.)

Hitchin.—May 11th. Electricity Department. One 1,500-kVA and three 250-kVA transformers. (See this issue.)

Hoylake.—May 31st. Water Department. One 100-kW Diesel engine generator. Clerk of the Council.

Irvine (AYRSHIRE).—May 9th. Town Council. Electric lighting for 126 houses at Springbank. Town Clerk (deposit £1 1s.).

London.—STEPNEY.—May 16th. Electricity Supply Undertaking. House service meters, demand indicators, conduits, troughs and covers and electric lamps for twelve months. (April 22nd.)
DEPTFORD.—April 30th. Borough Council. Electric lighting installation at Evelyn Public Baths. (April 22nd.)

Long Eaton.—April 30th. Electricity Department. Mercury arc rectifying equipment. (April 15th.)

Manchester.—May 9th. Electricity Department. Three mercury arc rectifier equipments. (April 22nd.)

Middlesex.—May 16th. County Council. Electrical installation in connection with extensions to the Stationers' Company School, Hornsey. (April 22nd.)
June 3rd. Electrical installation at the West Middlesex County Hospital extension, Isleworth. (See this issue.)

Newcastle-on-Tyne.—May 3rd. Tyne Improvement Commission. Hydraulic accumulator and electrical control gear for Tyne Dock, South Shields.
City Council. Installation of two-way electric switches in 969 houses on the Walker, Daisy Hill and Stamfordham Road estates. City architect, 18, Cloth Market.
North-Eastern Housing Association. Electrical installation in twenty-eight houses at Crook. E. W. Ayton, architect, Council Offices, Crook.

Newport.—May 17th. Electricity Department. One 30,000-kW turbo-alternator and condensing plant, complete with ancillary plant, pipework, &c. (April 15th.)

New Zealand.—WELLINGTON.—June 1st. Posts and Telegraph Department. Telephone cable. (T. 20465/38.)*
June 9th. 6,600-ft. of telephone cable. (T.Y. 20903/38.)*
May 31st. One d.c. motor generator set complete with accessories and spares. (T.Y. 20758/38.)*
AUCKLAND.—May 23rd. Electric Power Board. 42,000 l.v. porcelain insulators. (T. 20907/38.)*

Normanton.—Electricity Department. 475 yd. of 10,000-V overhead electric lines complete with poles, stays, &c., and 270 yd. of e.h.v. cables.

Peeblesshire.—May 7th. Education Committee. Heating and electrical installations at new Central School at West Linton. Reid and Forbes, 17, Great Stuart Street, Edinburgh.

Sheffield.—May 10th. Electricity Department. Distribution transformers. (April 22nd.)
May 6th. Transport Department. Materials, including traction lamps, cables, armature coils and commutators. Town Clerk, Town Hall.

South Africa.—JOHANNESBURG.—May 18th. City Council. Street lighting lanterns, chokes for mercury-discharge lamps and metal-clad condensers. (T.Y. 20329/38.)*
May 21st. Twenty-two h.v. circuit-breakers complete with accessories. (T.Y. 20940/38.)*
May 7th. Six cable sheath fault detective panels. (T.Y. 20755/38.)*
May 26th. Union Tender and Supplies Board. Secondary cell batteries. (T. 20683/38.)*
PORT ELIZABETH.—May 12th. City Electrical Engineer's Department. E.h.v. and l.v. cables. (T.Y. 20813/38.)*
Meter-testing equipment and portable instruments. (T.Y. 20730/38.)*
GERMISTON.—May 9th. Municipal Council. One 90-kW electric generator set complete. (T.Y. 20772/38.)*
PIETERMARITZBURG.—May 5th. Electricity Supply Department. 30-, 60- and 200-A house service fuse boxes. (T.Y. 20520/38.)*
Cables for twelve months. (T. 20517/38.)*
Copper wire for twelve months. (T. 20519/38.)*

Thornton.—May 2nd. Electricity Department. Cables and cable tiles for twelve months. (April 22nd.)

Uruguay.—MONTEVIDEO.—May 9th. Electricity Supply and Telephones Administration. Diesel-electric generating sets. (T.Y. 20130/38.)*

Walton and Weybridge.—May 18th. Electricity Department. One e.h.v. 11,000-V feeder cable and two 300-kVA three-phase transformers. (See this issue.)

West Ham.—June 17th. Electricity Department. One 200-kW electric generator and one five-panel switchboard. (See this issue.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Barrow-in-Furness.—Electricity Committee. Accepted for twelve months. Cables.—B.I. Cables; Cromnton Parkinson & Co. Cookers.—English Electric Co.; Revo Electric Co.; Hotpoint Electric Appliance Co.; Tricity Cookers.

Brighton.—Hospital Committee. Accepted. Electrical installation at mental colony (£586).—Page & Miles.

Coatbridge.—Town Council. Accepted. Electrical installation for the Woodside Street housing scheme, No. 2.—A. Finlay.

Croydon.—Cemetery Committee. Recommended. Duplicate electric furnace at the crematorium (£1,650).—Birmingham Electric Furnaces.
Electricity Committee. Recommended. Switchgear modifications (£12,107).—English Electric Co.

Ealing.—Education Committee. Electrical wiring at the Modern School:

	£		£
Cox and Hembrow. Accepted ...	**907**	A. H. Cornwall	1,373
Mead Electric Co.	954	Pinching and Walton	1,498
Watson and May	1,068	Holliday, Hall and Stinson ...	1,535
Bilton Smith	1,165	Fullick and Loosley	1,591
Honor Bros.	1,275	Knight and Hitchcock	1,989
Springvale Electrical Co. ...	1,295		

Electricity Committee. Wiring of hired apparatus: The first column relates to the installation of a cooker and 1½-gal. and immersion water heaters (per house) and the second column to a cooker and 1½-gal. and storage (12-gal.) water heaters (per house):—

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
T. Field. Recommended ...	**5 13 0**	**6 17 9**	Honor Bros. ...	7 5 0	8 2 6
Watson and May	6 0 0	7 8 6	Cox and Hembrow	7 4 0	8 7 6
Harris and Gubbins	6 5 1	7 8 5	Harnden and Frost	7 19 6	8 19 0
Mead Electric Co.	6 2 0	7 16 9	W. H. Newton...	10 5 0	10 5 0

Eston.—Electricity Committee. Accepted. Cable for extensions to Lowfields estate.—B.I. Cables.

Gateshead.—Town Council. Accepted. Lighting of Lobley Hill Road.—North-Eastern Electric Supply Co.

Gravesend.—Electricity Committee. Recommended. Meter-testing equipment (£425).—Chamberlain & Hookham.

Hull.—Education Committee. Accepted. Electrical installation in schools. Cooper (£528).—Booker & Tarran. Day Street (£394).—A. Lee. Priory Road (£398) and Wold Road (£398).—T. A. Garness.

Leeds.—Health Committee. Accepted. Electrical work at the hospital (£1,995).—F. H. Snowden. X-ray installation at St. James's Hospital (£3,455).—General Radiological.

London.—L.C.C.—Wiring and fittings for rewiring the east and west isolation blocks at Queen Mary's Hospital for Children, Carshalton:

	£		£
E. & C. Champion Accepted ...	**620**	Francis Polden & Co.	1,030
Archibald Meckhonik	685	Berkeley Electrical Engineering Co.	1,034
A. J. Hewens & Sons	959	Springvale Electrical Co. ...	1,038
Gillham and Jones	995	Buchanan and Curwen	1,042
Pinching and Walton	1,020	A. Dean & Co.	1,076
F. H. Wheeler & Co.	1,024		

Wiring and fittings for rewiring the electric lighting installation at Farmfield, Horley:

	£		£
Horley and District Electricity Supply Co. Accepted.	**2,060**	Malcolm and Allan (London) ...	2,713
Pinching and Walton	2,438	Buchanan and Curwen	2,825
F. H. Wheeler & Co.	2,587	T. Clarke & Co.	2,886
W. J. Furse & Co.	2,635	Jacob White & Co.	2,913
Duncan Watson (Electrical Engineers)	2,641	Carr Brothers ... ... Grant and Blake	2,960 2,963
		F. G. Edey & Co.	3,000

Wiring and fittings for electric lighting and power at Ongar Residential School:

	£		£
Read and Partners Accepted ...	**2,510**	Archibald Meckhonik	3,420
Duncan Watson (Electrical Engineers)	3,014	T. Clarke & Co.	3,640
Buchanan and Curwen	3,034	Samuel Reed & Sons	3,745
City Electrical Co.	3,131	Jacob, White & Co.	3,762
Pinching and Walton	3,290	Evans and Shea	3,781
F. E. Wheeler & Co.	3,355	F. G. Edey & Co.	3,799
Francis Polden & Co.	3,382	Alexander Hawkins & Sons ...	3,925

BATTERSEA.—Electricity Committee. Accepted. Thermal storage heating at Electric House buildings (£981).—Bastian & Allen. Two 500-kVA transformers (£580).—British Electric Transformer Co. Switchgear (£971).—Crompton Parkinson. Three distribution panels (£177).—Henley's. Cables for two years.—Callender's.

HACKNEY.—Electricity Committee. Recommended. Copper conductors for the underground distribution system for twelve months (£20,241).—B.I. Cables. Tenders were also received from Aberdare Cables, Ltd. (£20,259), and from Ismay Cables, Ltd. (£19,535). After considering the report of the borough electrical engineer, however, the Committee recommended the acceptance of the tender of British Insulated Cables, Ltd.

Housing Committee. Recommended. Electrical installation for the Hindle Street housing scheme (£3,503).—Pinching & Walton.

HAMMERSMITH.—Electricity Committee. Recommended. Ironclad cut-outs: Concentric (£279), Siemens Electric Lamps and Supplies; and four-core (£173), Henley's. Disconnecting boxes (£503).—Henley's. Service and joint boxes (£649).—W. Lucy & Co. Maximum demand indicators (£242).—P. & B. Engineering Co.

Lowestoft.—Electricity Committee. Accepted. Service boxes.—Strebor Diecast Co. (£335); Henley's (£47). Twenty-seven underground link disconnecting and three feeder pillars (£403).—Siemens Bros. Four transformers (£185 each).—G.E.C. Cable (£4,385).—Crompton Parkinson.

Manchester.—Housing Committee. Accepted. Electrical installations in 221 flats at West Gorton.—E. M. Evans & Son.

Electricity Committee. Accepted. Static transformers for twelve months.—Ferranti.

Portsmouth.—Contracts Committee. Accepted. Meter boards and cut-outs.—B.I. Cables. Joint boxes.—Callender's; Lucy & Co.; Henley's; B.I. Cables.

Tynemouth.—Housing Committee. Accepted. Electrical installations in thirty-six houses at Queen Street (£143).—Bonham Electrical Engineering Co.

Forthcoming Events

Institution of Electrical Engineers (*Wireless Section*).—Wednesday, May 4th. Institution, London, W.C.2. 6 p.m. Lecture on "Researches in Radio Telephony." Dr. R. Bown.

Meter and Instrument Section.—Saturday, May 7th. Summer visit to Manchester and district.

Northern Ireland Sub-Centre.—Wednesday, May 4th. Grand Central Hotel, Belfast Conversazione.

Irish Centre.—Thursday, May 5th. Royal Hibernian Hotel, Dublin. Conversazione.

Scottish Centre.—Friday, May 6th. Training College Hall, Park Place, Dundee. 7.30 p.m. The Faraday Lecture. Dr. A. P. M. Fleming. Saturday, May 7th. Excursion from Dundee to Taymouth Castle Hotel.

Society of Chemical Industry (*Chemical Engineering Group*).—Friday, April 29th. Waldorf Hotel, Aldwych, London, W.C.2. 6.45 p.m. Annual general meeting and dinner.

Institution of Civil Engineers.—Tuesday, May 3rd. Great George Street, Westminster, S.W.1. 5 p.m. Presentation of the Kelvin Medal to Sir J. J. Thomson. 6 p.m. James Forrest Lecture. "Disorderly Molecules and Refrigerating Engineering." Sir F. E. Smith.

Iron and Steel Institute.—Wednesday, Thursday and Friday, May 4th, 5th and 6th. Institution of Civil Engineers, Great George Street, Westminster, S.W.1. 10 a.m. each day. Annual meeting and symposium on "Steelmaking."

Junior Institution of Engineers.—Thursday, May 5th. 21, Albemarle Street, Piccadilly, W.1. 7.30 p.m. "Early Links between Science and Engineering." Sir W. Bragg.

Birmingham Electric Club.—Friday, May 6th. Summer visit to the G.E.C. Lamp Works, Wembley.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

FENO universal midget connector.
DING DONG hack saw blades.
ANKER washing machines.
BAR refrigerators.

Readers should enclose stamped addressed envelopes when making their inquiries.

Notes

Fire Protection

A fire demonstration was arranged last week by Newalls Insulation Co. (a branch of Turner & Newall, Ltd.) in the vicinity of the Barking power station at Creeksmouth, Essex (by permission of the County of London Electric Supply Co., Ltd.) with the object of indicating how steel structures and electric cables can be protected by covering them with moulded asbestos. A rectangular brick housing with 14 in. thick walls had four "roof" members, consisting of 6 in. by 3 in. rolled steel joists (12 lb.), each pair carrying a load of 2.5 tons of red bricks. In addition, five samples of 2 in. pipes and cables were arranged vertically within the chamber, insulated in the following ways with asbestos coverings: 3 in. thick moulded on, 1 in. thick moulded troughing, 1 in. thick sheeting and 1 in. thick corrugated moulding; while the fifth example was an unprotected lead-covered, paper-insulated cable. The fire within the chamber was fed with used transformer oil and thermocouples enabled temperatures to be measured in an adjoining hut. Eleven minutes after the fire started the unprotected pair of joists had become distorted and collapsed entirely, while the bare cable had been destroyed by burning. Nearly an hour later, the fire still burning, the protected cables appeared to be unharmed and the pair of joists which had a 1 in. thick covering of moulded asbestos faced with a refractory wash remained intact and continued to carry its load without distortion. Asbestos can be moulded to fit almost any size of girder or angle and in round and elliptical sections for cables.

World Power Conference

It is announced officially that, notwithstanding recent political events, the Vienna sectional meeting of the World Power Conference will be held between the dates already fixed (August 25th to September 2nd, 1938) and that the programme remains unaltered. Herr Ing. R. Reich, the chairman of the former Austrian National Committee, and his colleagues have been asked by the German National Committee to continue their preparations for the holding of the sectional meeting, which will be organised from Vienna itself. Thus, full continuity is assured. At the recent annual general meeting of the British National Committee it was decided unanimously to proceed with preparations for British participation in the Vienna meeting. Sir Harold Hartley has again been elected chairman of the British National Committee to serve for a further term of three years. Sir Harold is also chairman of the International Executive Council. The annual report of the W.P.C. for 1937 has now been issued from 36, Kingsway, London, W.C.2. It shows that new national committees have been formed in Colombia and Estonia, which countries had previously possessed representatives only. The fourth plenary meeting is to be held in Tokyo in 1942.

Providing for Growth of Railway Traffic

Discussing the need to pay attention to the traffic-forming capacity of a railway when preparing designs for electrification, Professor E. W. Reuleaux, in the *Deutsche Bergwerks Zeitung*, combats the view that a line through unexploited country should be constructed "as cheaply as possible." He instances the case of a single-track railway through hilly country, the initial designs for which were sound except in one respect. The distance between stations, where alone two trains travelling in opposite directions could cross, varied generally from 6¼ to 12½ miles. In one case, however, the distance was nearly 17 miles, and this limited the capacity of the whole line of 186¼ miles to twelve trains per day running at 18½ m.p.h. in each direction. With maximum distances of 6¼ and 12½ miles, capacities of 36 and 18 trains per day could have been obtained. Only a slight addition to the original scheme would have been required to provide for the crossing of two trains at 6¼-mile intervals when growth of traffic made this desirable, whereas the arrangement originally proposed would have called for expensive reconstruction.

I.E.E. (Western Centre)

The summer meeting of the Western Centre of the Institution of Electrical Engineers will be held at Llandrindod Wells from June 17th to 20th. The provisional programme includes the annual meeting on June 17th with an informal dinner and dance in the evening. On the next day there will be a motor coach tour to Devil's Bridge, and in the evening the Western Centre dinner and dance will be held. On June 19th there will be a golf competition on the course of the Llandrindod Golf Club and an informal dinner in the evening.

High-frequency Valves

The utilisation of frequencies greater than two megacycles per second for radio communication, electro-medical purposes, etc., is referred to in the paper by Mr. B. Drake that was read before the London Students' Section of the Institution of Electrical Engineers on April 25th. The author points out that for the production and uses of frequencies of this order the thermionic valve is an essential element, and also the limiting factor. Residual capacitances and inductances, and transit time effects, are discussed, and a minimum size for normal-type valves is suggested. Electronic, resonator valves of the "Magnetron" and Barkhausen-Kurz type are described, and a plea is put forward for the development of ultra-high-frequency amplifier valves.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. G. C. H. Matthey has completed twenty-five years' service as a director of Johnson, Matthey & Co., Ltd., and on April 8th nearly 400 people gathered at the company's head offices in Hatton Garden to witness the presentation of a desk and book of signatures to him to mark the occasion. Mr. Baker, who presided over the proceedings, in making the presentation, said that Mr. Matthey was brought up in the traditions of his grandfather and he had done all that he could to respect and preserve those traditions. At the same time, however, he had moved with the times and had introduced new chemical and metallurgical processes together with modern ideas, and they believed the blending of the old with the new policy adopted by the directorate and the staff had gone a long way to make for the success of their business to-day. He referred to Mr. Matthey's interest in all matters connected with the staff and works. Mr. Matthey, in reply, said that the gift would always remind him of the goodwill they had towards him.

Mr. L. E. Mold, contracts manager, **Mr. B. H. Leeson,** technical manager, and **Mr. W. A. Harriman,** works manager, have been appointed to the board of A. Reyrolle & Co., Ltd. These gentlemen have been associated with the company and its developments for many years.

Mr. T. S. Seymour, who since 1927 has been commercial manager of the Metropolitan Electric Cable & Construction Co., Ltd., has resigned that position in order to take up another appointment. His present address is 19, Airlie Gardens, Ilford, Essex.

At a recent meeting of the Barrow-in-Furness Corporation Electricity Committee the chairman referred to the impending retirement of **Mr. H. R. Burnett,** borough electrical engineer, and to the fact that this was the last meeting at which Mr. Burnett would be present and the Committee placed on record its appreciation of the loyal and efficient service rendered by Mr. Burnett during the forty years he has occupied the position of borough electrical engineer. Mr. Burnett joined the Institution of Electrical engineers as an associate in 1895 and became an associate member four years later.

Mr. A. A. Toon, of the Hull Corporation Electricity Department, has been appointed meter superintendent to the Burton-on-Trent Corporation Electricity Department. Before going to Hull, Mr. Toon was assistant meter superintendent at Wallsall.

Mr. A. Philips, president of the Philips concern, of Eindhoven was one of the donors of the newly discovered painting by Vermeer to the Boymans Museum, Rotterdam. The picture was purchased by Mr. Philips and two others for £62,000.

Mr. E. F. Harrison has been appointed chairman (*pro tem.*) of Franco Signs, Ltd., in place of the late Marquess of Milford Haven.

Mr. F. Parmenter has been appointed a director of the British Thermostat Co., Ltd.

Mr. G. L. Drury, of Darlington, has retired from the L.N.E.R. after thirty-four years' service. He was born at Dublin and joined the North-Eastern Railway Co. in 1904, and in 1919 was appointed works manager at Walkergate, Newcastle-on-Tyne. When the company became the L.N.E.R. he became assistant electrical engineer in charge of all electrical equipment in the North-East area. He took part in the first commercial wireless experiments carried out by Marconi in 1898 in the Irish Channel.

Mr. S. Burns, M.I.E.E., M.I.Min.E., is resigning his appointment with the North-Eastern Electric Supply Co., Ltd., at the end of the month in order to enter business on his own account. Mr. Burns was appointed deputy engineer, Electrical Section, Change of Frequency Department, in May, 1930, and latterly has taken charge of this important work throughout the company's area of supply. His resignation coincides with the virtual completion of change-over on the North-East Coast. His agency office, at 21, Mosley Street, Newcastle-upon-Tyne, 1, is to be opened on May 2nd.

Mr. E. V. Cooke has joined the staff of the Horstmann Gear Co., Ltd., Bath, as representative for London and the Home Counties. He is taking up his duties immediately.

Mr. E. C. Hallam, resident engineer of the Wantage branch of the Wessex Electricity Co., was recently married at the Cathedral Church of St. James, Bury St. Edmund's, to Miss Mary Louise Boyce, of Bury St. Edmund's.

Mr. R. Parker, assistant to the public lighting engineer at Sheffield, has been appointed superintendent of lighting to the Aberdeen Corporation in succession to Mr. A. Forbes.

Mr. S. H. Baker, for two years combustion engineer at Prince Rock power station, Plymouth, who has been appointed assistant mechanical and electrical engineer to the Colne Valley Water Co., Watford, has been presented with an engine-turned silver cigarette box by **Mr. H. Midgley,** the city electrical engineer, on behalf of colleagues in the Electricity Department.

Mr. H. Chenery, of the East Anglian Electric Supply Co., Ltd., Braintree, has been appointed resident manager of the company at Southwold.

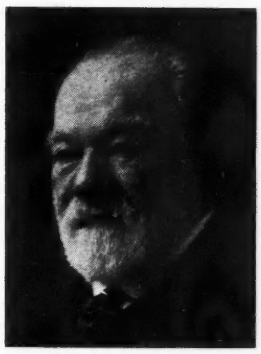
Mr. E. W. Callow, assistant mains engineer of the Stepney Borough Council, has been appointed distribution engineer to the Stoke Newington Borough Council Electricity Department.

Mr. H. J. Grewing has retired from the board of the Oriental Telephone & Electric Co., Ltd,. after forty years' service, and at the annual meeting of the company on Tuesday last a resolution was passed for the payment to him by the board of £2,500 in recognition of his services.

Mr. A. Brookes, M.Eng., M.I.E.E., M.Inst.P., chief chemist with Micro-Lead Products (Ericsson), Ltd., will give a lecture before the Birmingham Paint, Varnish and Lacquer Club on May 5th at the Grand Hotel, Birmingham, on the subject of "A New Process Red Lead."

Obituary

Mr. G. C. Lundberg.—We regret to record the death of Mr. Gustaf Charles Lundberg, of A. P. Lundberg & Sons, Ltd., which occurred on April 21st at the age of seventy-one. Mr. Lundberg was apprenticed to his father, the founder of A. P. Lundberg & Sons, in 1882, having been educated at the Haberdashers' School, Polytechnic and City and Guilds College. In 1888 he went to the United States and entered the employ of the Bentley-Knight Electric Railway Co., of Allegheny, where an electric line was constructed which was one of the pioneer applications of electricity for tramway work in the United States. On the merging of the interests of the Bentley-Knight companies with the Thomson-Houston concern, Mr. Lundberg went to Boston, where he acquired considerable experience in the equipment and running of the street-car system of the West End Street Railway Co. with electric motors. Leaving Boston, he was engaged for some time on experimental work on the system of the Baltimore and Ohio Railway Co., in Staten Island, N.Y. He returned to England in 1890 and re-entered his father's works as his assistant, ultimately becoming joint managing director with his brother, Mr. P. A. Lundberg. He retired from the business some time ago, and Mr. P. A. Lundberg is now the managing director. Mr. G. C. Lundberg was a Royal Warrant holder to their late Majesties Edward VII and George V, and was a member of the I.E.E. He was joint author with the late Mr. W. Perren Maycock of "Lektrik Lighting Connections."



[*Elliott & Fry*

The late Mr. G. C. Lundberg

Mr. A. M. Codd.—We regret to record the death of Mr. Arthur Mortimer Codd, F.P.L.S., which occurred on April 20th at Esher at the age of fifty-seven. Mr. Codd will be remembered by many of our readers by his contributions to the ELECTRICAL REVIEW a few years back on primary batteries and wet cells, while as recently as December last he contributed an article to our pages on "Electrostatic Generators," in which he described a special form of machine which he had constructed.

Mr. W. F. Kerr.—The funeral took place at Jarrow-on-Tyne recently of Mr. W. F. Kerr, who for three years was a director of the Bushboard Co., Ltd., Gateshead. He was fifty-two years of age. For twenty-eight years he was connected with the Dick, Kerr Electrical Engineering Co., Ltd., Preston, which afterwards became the English Electric Co. Later he worked for a Birmingham firm of consulting electrical engineers. He was an associate of the I.E.E., and went to Tyneside four years ago.

Mr. H. Holt.—We regret to record the death of Mr. Herbert Holt, of G. S. Peckham & Co., which occurred on April 16th. Mr. Holt was at one time works manager for Rhodes Motors, Ltd., having previously served his apprenticeship with Fowler's & Verity's. When Rhodes Motors closed down he went into business on his own account as a wholesaler in Doncaster, and for the past six years had been with Messrs. G. S. Peckham & Co.

Earthing to Water-pipes

The report for the two years 1935-37 of the Research Committee of the Institution of Civil Engineers, which is obtainable from the secretary, reveals that the recommendations for proposed regulations in respect of earthing to metal water-pipes and mains have been completed and await approval by the bodies concerned.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

British Electric Domestic Appliances (1938), Ltd.—Private company. Registered April 22nd. Capital, £7,500. Objects: To carry on the business of manufacturers of and dealers in vacuum cleaners, electric irons, radiators, hair-dryers, washing machines and appliances, &c. The subscribers are: K. E. Beart and F. G. Maw, both of Amberley House, Norfolk Street, W.C.2. Registered office: 12, Norfolk Street, W.C.2.

Diamond Accumulator Co., Ltd.—Private company. Registered April 19th. Capital, £500. Objects: To acquire the business of accumulator manufacturers carried on by L. A. and L. A. J. Baylis as the Diamond Accumulator Co., at The Chase, Bournemouth Park Road, Southend-on-Sea. The life directors are: L. A. Baylis, 16, Northumberland Crescent, Southend-on-Sea, and L. A. J. Baylis, 27, Surbiton Avenue, Southend-on-Sea. Registered office: 47, Alexandra Street, Southend-on-Sea.

Madison Appliances, Ltd.—Private company. Registered April 20th. Capital, £1,000. Objects: To carry on business as manufacturers and sellers of electrical and mechanical machinery and apparatus, &c. The directors are: H. V. Lewis, 31, Beech Lawns, Torrington Park, N.12, B. S. Scott, 323, Bilton Road, Perivale, Greenford, Middlesex, and J. G. Daniel, 21, Bradford Drive, Ewell, Surrey. Secretary: J. G. Daniel. Registered office: Windsor House, 46, Victoria Street, S.W.1.

Garratt Electric, Ltd.—Private company. Registered April 19th. Capital, £1,000. Objects: To carry on the business of electrical and general engineers, manufacturers of electrical appliances, &c. The first directors are: E. C. Garratt, 34, West Hill Avenue, Hednesford, Staffs, and T. Gatis, 38, Wrottesley Road, Tettenhall, Wolverhampton. Registered office: Eagle Works, Wednesfield, Wolverhampton.

Industrial Processes, Ltd.—Private company. Registered April 14th. Capital, £2,000. Objects: To acquire the benefit of an invention for "Improvements in or relating to the manufacture of covered wire," and to adopt an agreement with W. Stoker. The subscribers are: E. A. McNeill, C.A., 4, Queen's Avenue, Woodford Green, and Miss G. E. Hicks, 86, Chestnut Rise, S.E.18. Registered office: 82, King William Street, E.C.4.

F. D. Bailey, Ltd.—Private company. Registered April 9th. Capital, £1,000. Objects: To carry on business as manufacturers of and dealers in gramophones and sound reproducing machines, radio and television apparatus, &c. The subscribers are: A. H. Lines, 153, The Parade, Watford; and F. D. Bailey, 1F, Market Street, Watford. Registered office: 1F, Market Street, Watford.

Watts & Baker, Ltd.—Private company. Registered April 9th. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in television and radio apparatus, &c. The directors are: E. G. Hill (chairman and permanent managing director), and H. Hill, both of 14, Lovat Close, Neasden, N.W.2. Secretary: Mrs. H. Hill. Registered office: 29a, Walm Lane, Willesden Green, N.W.2.

Radio Home Entertainments, Ltd.—Private company. Registered April 9th. Capital, £100. Objects: To carry on the business of dealers in all kinds of electrical, radio and telephone appliances and accessories, &c. The directors are: J. Sweetmore, 101, Marsden Road, Burnley; W. Ashworth, 4, Rossendale Avenue, Burnley; and W. Marshall, 19, Hollin Hill, Burnley (all directors of Sweetmore's Relay Services, Ltd.). Registered office: Corporation Gate Entrance, Abel Street, Burnley.

B. M. Ayre & Son, Ltd.—Private company. Registered April 9th. Capital, £500. Objects: To carry on the business of electricians, mechanical engineers, &c. The subscribers are: J. L. R. Robinson, 36, Palace Road, N.8; and H. Lynch, 32, Felden Street, S.W.6. Secretary: J. L. R. Robinson. Registered office: 36, Palace Road, Crouch End, N.8.

West of England Electrics (Bristol), Ltd.—Private company. Registered April 21st. Capital, £1,000. Objects: To acquire the business of electrical engineers heretofore carried on by the West of England Magneto Repair Co. at 35/7, Stokes Croft, Bristol. The directors are: E. A. Goodman, 54, Hampton Park, Redland, Bristol; and J. S. Routley, 227, Coronation Road, Southville, Bristol. Solicitors: Latchams & Montague, Chipping Sodbury and Bristol.

Returns of Electrical Companies

Amesbury Electric Light & General Supply Co., Ltd.—Satisfaction in full (1) on January 17th, 1934, of debentures authorised December 27th, 1922, and registered December 29th, 1922, securing £2,500, (2) on same date of debentures authorised August 25th, 1924, and registered August 28th, 1924, securing £1,000, and (3) on January 11th, 1938, of mortgage dated September 15th, 1924, in favour of the Midland Bank, Ltd., and registered September 24th, 1924. Notices filed April 12th, 1938. (According to the register of mortgages, the mortgage registered September 24th, 1924, originally secured all moneys due to bank.)

Farr's Electric, Ltd.—S. L. T. Crawford, of 83, Cannon Street, E.C., was appointed receiver and manager on April 11th, 1938, under powers contained in instrument dated April 6th, 1938. Debenture, charged on the company's undertaking and property, present and future, including uncalled capital, dated April 6th, 1938, to secure all moneys due or to become due or incurred by the company to Arc Trading Co., Ltd., 6, Charterhouse Buildings, E.C.1, not exceeding £5,000.

Vio-Ray Electric Co., Ltd.—Capital, £1,000 in £1 shares. Return dated December 31st, 1937. 377 shares taken up. £377 paid. Mortgages and charges, nil.

West Riding Radio Relay Service, Ltd.—Capital, £25,000 in 15,000 7 per cent. cumulative preference shares of £1 and 200,000 ordinary shares of 1s. Return dated December 10th, 1937. 7,040 preference and 50,384 ordinary shares taken up. £9,557 14s. paid. Mortgages and charges, nil.

Gilbert's Electrical, Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated April 1st, 1938, to secure £200. Holder: C. J. Gilbert, 3, Shouldham Street, W.1.

International General Electric Co., Ltd.—Capital, £100,000 in £1 shares. Return dated December 31st, 1937. 25,100 shares taken up. £25,100 paid. Mortgages and charges, nil.

J. S. Perese, Ltd.—Satisfaction in full on March 21st, 1938, of debentures registered November 22nd, 1935, securing £300.

Brush Electrical Engineering Co., Ltd.—Debenture charged on moneys payable under certain contracts, &c., dated April 5th, 1938, to secure £25,000. Holders: C. Hoare & Co., 37, Fleet Street, E.C.4.

Electronaire Marketing Co., Ltd.—Particulars filed of £20,000 debentures, authorised January 6th, 1938, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £1,500 (on April 11th, 1938).

Day & Co. (Electrical), Ltd.—D. A. Jacobs, of 74, Newman Street, W.1, ceased to act as receiver and manager on April 11th, 1938.

Britannia Switchgear & Electrical Equipment Co., Ltd.—R. H. Fowler, accountant, of 141, Moorgate, E.C.2, was appointed receiver and manager on April 8th, 1938, under powers contained in debenture dated July 26th, 1937.

"T.X." Products Co., Ltd.—F. W. Inns, of Finsbury Court, Finsbury Pavement, E.C.2, was appointed receiver on April 9th, 1938, under powers contained in debenture dated July 9th, 1937.

Carbo Electric Corporation, Ltd.—Capital, £100 in 100 shares of £1 each. Return dated December 31st, 1937. Two shares taken up. £2 paid. Mortgages and charges, nil.

City Notes

The Electric Supply Corporation, Ltd., held its annual meeting on April 25th, when Mr. A. J. Fippard (chairman), who presided, said that the number of consumers added to the mains of their undertakings at Dumbarton, Falmouth and St. Andrews during 1937 totalled 599, as compared with 453 in 1936. In the case of the subsidiary companies the number added was 2,065, as compared with 2,184 in 1936. The total number of consumers connected at the end of 1937 was 19,346, an increase of 2,664. The sales by the Corporation's undertakings amounted to 12,271,000 kWh in 1937, as against 11,404,000 kWh in 1936, while the sales by subsidiary companies increased by 28 per cent. to 23,887,000 kWh. A further part of the system at Dumbarton had been changed over to a.c. The whole of the bulk supplies at Falmouth and St. Andrews were now taken indirectly from the Central Electricity Board, and the system changed over to a.c. The charges had been reduced in anticipation of increased sales. Show and demonstration rooms would be available at Falmouth in the course of the next few weeks, and a new showroom and office at Peterhead to replace the showroom destroyed by fire would be ready for occupation at an early date. Progress had been good in the Sussex areas, but the financial results were disappointing owing to increased costs common to all supply undertakings. Although a decision to increase charges would be regrettable, such a decision might have to be reached in view of the unusually low charges now made, which left no margin for the increasing costs and the decreasing revenue per kWh sold.

United Kingdom Gas Corporation, Ltd.—In the course of his speech at the annual meeting on April 25th Mr. R. B. H. Ottley (chairman), in referring to the rising cost of materials, said that the increase in general materials was to some degree offset by the advantage they were able to secure by corporate purchasing, but it was likely that they would have to raise the price of gas to their consumers in many companies, which would tend to handicap them in the continual struggle for new load which they had to wage with the electricity companies, who employed only 13,000,000 tons of coal as against their 18,000,000. They did not fear the competition of electricity in the heating field, particularly as it was their intention to introduce sales promotional tariffs throughout their companies. The present competition in all fields of activity between electricity and gas was insensate and uneconomic. There were spheres for which gas—as a basic heat—was better adapted than electricity. There were spheres in which electricity—as basic power—was better adapted than gas. But, at the present time, each industry squandered its energy and resources in attempting to deprive the other of its load regardless of any logical considerations. This was a matter that could be solved either by voluntary negotiation of the respective interests or by Governmental intervention.

The Oriental Telephone & Electric Co., Ltd., held its annual meeting on April 26th when Sir A. Henry McMahon (chairman), who presided, said that their Singapore branch showed progress, having added 387 exchange lines during the year. The Mauritius branch again showed a loss and it was clear that if their system and that of the Government were combined much overlapping would be avoided and considerable economies in management made possible. An agreement in principle had been arrived at for the purchase of their system by the Government, and during the current year the Government would take over their system. The Bombay Telephone Co. continued to make good progress with the addition of 2,268 new exchange lines during the year, and had again paid 8 per

cent. for 1936. The Bengal Corporation had added 1,399 new exchange lines, and had paid an additional 2 per cent. by way of bonus for the year ended June 30th, 1937, making 10 per cent., and the Madras Co. paid the usual 8 per cent., plus a bonus of 1 per cent. The Rangoon Co. had also made some progress, and a new method of charging was introduced as from January 1st this year, the results of which, so far, had been encouraging. The dividend was maintained at 6 per cent. The Hongkong Telephone Co. had added 1,085 new exchange lines, despite the conditions prevailing in China during the latter half of the year, and had paid dividends amounting to 12 per cent. for the year, which had enabled the China and Japan Telephone & Electric Co. to make its usual distribution of 6 per cent.

The West London & Provincial Electric & General Trust, Ltd., reports a net revenue for the year ended March 31st of £21,861, as compared with £20,129 for 1936-37. The ordinary dividend for the year is maintained at 6½ per cent., £2,500 is placed to general reserve, and £5,764 is carried forward, subject to directors' additional remuneration (against £3,255 brought in).

Franco Signs, Ltd.—The annual meeting was held on April 21st, when Capt. C. A. L. Irvine, who presided by reason of the death of the late Marquess of Milford Haven, said that apart from normal increases in the subsidiary companies' assets, occasioned by the improved trading results, a large increase had taken place owing to their having acquired the business of Boro' Electric Signs as at August 16th, 1937, for £53,500, no part of which was attributable to goodwill. This business had been doing a substantial turnover in both England and Scotland and they were able to acquire it on advantageous terms. The Boro' business had continued to receive a steady flow of orders and the profits of their subsidiaries for the year to September 30th, 1938, should be enhanced thereby. For the first six months of the new year the orders received, irrespective of those of the new company recently acquired, were in excess of those of the corresponding period last year.

Johnson & Phillips, Ltd., report a profit for 1937 of £219,488, as compared with £196,154 for the preceding year. From this is deducted maintenance and depreciation (£46,002), fees (£2,775), debenture service (£22,000), and taxes, pensions, &c. (£22,686), leaving £126,024. It is proposed to pay a final ordinary dividend of 7½ per cent., making 12½ per cent., less tax, for the year (against 10 per cent.), to place £5,000 to research account, £10,000 to dividend equalisation account and £20,000 to contingencies reserve, leaving a balance of £102,647 to be carried forward (against £111,623 brought in). Meeting: May 5th.

Babcock & Wilcox, Ltd., report a manufacturing profit for 1937, including income from subsidiary and associated companies, of £607,293, as compared with £471,336 in 1936, to which is added other income of £109,000, making a total of £716,293. The net profit is £626,058 (against £569,340). The pension funds receive £26,143, and it is proposed to pay a final ordinary dividend of 6 per cent., again making 10 per cent. for the year. A sum of £100,000 is placed to dividend equalisation fund, and a balance of £96,648 is carried forward (against £66,652 brought in). The report states that the volume of trade in both the home and export markets remained at the satisfactory high level of 1936. The international situation generally, and the restrictions on international trading, as well as the world economic position, did not alter for the better during the year under review, and the board considers it necessary to be conservative in the distribution of profits. Additions have been made to the works, including a new reducing mill in the tube works at Dumbarton. Meeting: May 5th.

The Calcutta Electric Supply Corporation, Ltd., reports a gross revenue for 1937 of £1,270,923, as against £1,278,589 for 1936. The directors state that there was a further substantial increase in revenue from industrial sources, but in the case of domestic supply, although the sales of electricity increased steadily, the revenue was lower, owing to the reduction of the domestic rate from 2¼ to 2 annas per kWh in March, 1937. The net revenue is £508,774 (against £532,458), and after providing for debenture interest, taxation, &c., it is proposed to pay a final ordinary dividend of 6 per cent. (against 7 per cent.), making 10 per cent., tax free, for the year (against 12 per cent.), and to carry forward £51,392 (against £40,545 brought in). The sales of electricity increased from 311,412,003 kWh to 348,236,650 kWh.

Cable & Wireless, Ltd., reports profits for 1937 of over £1,200,000 (the new standard revenue). The final dividend will be increased so as to make a total dividend of 3½ per cent. for the year instead of 2½ per cent. paid last year, and a sum of £300,000 will be placed to general reserve, which will therefore be available for equalisation of dividends and meeting the reduction in rates recently announced. The profit for 1937 is over £400,000 in excess of 1936 and is the best since the company was formed. In declaring the present dividend the company is following a conservative policy. In the past few years the rate reductions throughout the whole system have been estimated to cost between £400,000 and £450,000 per annum and the Empire scheme stabilises rate reduction within the Empire for five years or until the standard revenue is exceeded during that period.

Madras Electric Tramways (1904), Ltd., reports a gross profit for 1937 of £36,921, as compared with £32,095 for 1936. After providing for interest and London office expenses, £2,130 for the debenture sinking fund, and transferring £12,500 to depreciation and renewal account, there is a balance of £12,799, to which is added £8,500 brought in, making £21,299. The ordinary dividend for the year is 5 per cent., tax free (against nil), and £9,924 is carried forward. The traffic receipts for 1937 and the number of passengers carried show increases of 4.6 per cent. and 2.4 per cent., respectively, as compared with 1936.

The Great Northern Telegraph Co. (Ltd.), of Denmark, proposes to distribute a total dividend and bonus of 20 per cent. for 1937 (unchanged), including the 5 per cent. already paid. From interest on reserves, totalling Danish kr. 5,760,784 (£257,178) it is proposed to transfer to the revenue account kr. 5,760,000 (£257,143). Interest from other sources, amounting to kr. 97,452 (£4,350), shows a decrease of kr. 84,103 (£3,755). To the pension fund has been allotted kr. 500,000 (£22,321). The amount carried forward is kr. 10,527,462 (£469,976).

The Shanghai Electric Construction Co., Ltd., reports a profit for 1937 of £80,252, as compared with £119,736 for the preceding year, to which is added £25,392 brought in, making £105,644. After making provision for renewals (£35,000), it is proposed to pay a final dividend of 5 per cent., making 7 per cent. for the year (against 13 per cent.), and to carry forward £23,744. The report states that following the outbreak of Sino-Japanese hostilities on August 14th the tram and trolley-bus services were suspended for four days. Services were resumed in skeleton proportions in the areas south of the Soochow Creek on August 19th, and have been gradually extended whenever and wherever possible since then. At the close of the year the total service in operation represented about 40 per cent. of normal and at the date of the report that ratio had been increased to about 60 per cent.

The Ever Ready Trust Co. reports a revenue for the year ended March 31st of £33,764, as compared with £32,392 in the preceding year, from which is deducted fees, expenses and interest (£4,126), leaving a net revenue of £29,638. Reserve receives £5,164, and the final ordinary and deferred dividends are 5 per cent., making 8 per cent. (same) and leaving £2,755 to be carried forward against £2,281 brought in. A number of investments were sold in the early summer of 1937 and the profits realised have been employed in writing down the book value of the company's holdings. In addition, £26,000 has been transferred from capital reserve and applied to further writing down the company's holdings.

The Ever Ready Co. (Great Britain), Ltd., proposes to pay a final dividend of 20 per cent. on the ordinary capital, making 35 per cent. for the year on £944,765 of capital. This compares with the same rate on £836,502 for 1936-37. In view of the disturbed world conditions the directors do not recommend the payment of a bonus this year—last year there was a bonus of 10 per cent. The accounts to be issued on May 5th will show a net profit of £531,575, an increase of £4,242.

The Rangoon Electric Tramway & Supply Co., Ltd., reports a gross profit for 1937 of £176,957, as compared with £157,588 for the preceding year, to which is added difference on exchange, transfer fees, interest, and profit on sale of investments (£27,032), and £17,797 brought in, making £221,785. After providing for debenture interest, transfers to reserve, &c., there is an available balance of £59,562. The final ordinary dividend is Rs.1-2-0 per share (free of Burman tax), making 10 per cent. for the year (against 9⅛ per cent.), and £18,312 is carried forward.

The West Devon Electric Supply Co., Ltd., reports a net profit for 1937 of £22,135 (against £19,636 for 1936). The ordinary dividend for the year is maintained at 5 per cent., general reserve receives £1,000, and £1,468 is carried forward (against £1,332 brought in).

The British Thermostat Co. reports a profit for the year ended January 31st of £30,431, as compared with £32,061 in the preceding year. A final dividend of 11⅝ per cent. is paid, making 18½ per cent. for the year (against 17½ per cent.), and £12,847 is carried forward (against £10,166 brought in).

The Power Investment Corporation reports a profit of £40,223 for the year ended March 31st, as against £46,310 for 1936-37. The ordinary dividend is maintained at 4 per cent., and the balance carried forward is £33,824 (against £36,512 brought in).

The Quebec Power Co. is paying a dividend of 25 cents per share on the common shares for the quarter to March 31st (same).

The Adelaide Electric Supply Co., Ltd., has declared interim dividends of 4 per cent. on the 8 per cent. preferred ordinary and 5 per cent. (same) on the ordinary stock.

Stocks and Shares

TUESDAY EVENING.

BUDGET night is not exactly the time that any Stock Exchange commentator would select if he were given a choice for the writing of his article. The details come out after the Stock Exchange is closed, but dealers from various markets linger in Throgmorton Street to a later hour than they, other than the jobbers in American shares, usually stay. And on this, Tuesday, evening the first reaction of prices was definitely unfavourable. Most of the self-appointed prophets had assured people that any rise in the income-tax was highly improbable. Such had been the credence paid to this impression that the Chancellor's call for an extra sixpence in the £, making 5s. 6d. as the standard rate, led to declines in the comparatively few stocks and shares for which prices were obtainable after hours in the Street markets.

The Budget Effect

By a tradition that is well authenticated by experience, any increase in direct taxation must have a depressing effect upon Stock Exchange quotations. There are exceptions to the theory, but this week's course of markets is likely to fortify it. Our price lists are based upon the official levels that ruled a couple of hours before Sir John Simon spoke. Probably the majority of what "Budget changes" occur will be downward—an unfortunate sequel to the steadily rising tendency of prices over the past two or three weeks. Good dividends and satisfactory reports have been making their appearance, to the satisfaction of present shareholders and the expansion of fresh interest amongst prospective purchasers. The Budget may impose a check upon hopefulness, but Stock Exchange markets are as adaptable to circumstances as is human nature itself. No very long time will be required for the readjustment of values, of yields and views, of prospects and business. In less than a month, people will be thinking more about the Derby than about the Budget.

Cable and Wireless

Since news of the proposed agreement between Cable and Wireless and the Government, the future of the combine's stocks has had to be considered from an altered standpoint. Nevertheless, some significance was attached to the traffics index for March—the last full month in which the old rates prevailed. The figure of 74.7 for that month compares with 90.6 for March a year ago, and brings the average for the first quarter of 1938 to 73.3. For the opening three months of last year and of the year before the averages were 87 and 73.5 respectively, so that the volume of traffic has fallen to the 1936 level. From now on the monthly indices will reflect introduction of the new flat rate, and will give an idea as to how far inter-Empire traffic is stimulated by this concession to users of the system. The success of the scheme will depend, of course, mainly on the measure of the public's response to this bait. Since the altered charges only came into force this week, the April index will be no guide to the future; and thereafter an additional point for consideration will be the cancellation of £250,000 paid annually by the company as beam rental. Meanwhile, the ordinary stock has been marked ex the 4 per cent. dividend, and the price stands a little over 60.

Equipment and Manufacturing

At the beginning of the week Henley's Telegraph shares rose to 20s. as a result of the strong position shown in the report. Profits have risen to a figure which represents more than 30 per cent. on the ordinary share capital. The dividend of 20 per cent. is, therefore, a decidedly conservative distribution. Thus encouraged, the group of cable manufacturing shares again scored a general advance which left prices to face the Budget from a level well ahead of recent low points. In the past three weeks Callenders have risen from 4 7/8 to 4⅝, and British Insulated from 4¼ to 4 7/8. Hopes of an increase in the dividend now due from Siemens caused a half-crown rise in the price of the shares to 30s. Lancashire Dynamos were an equal amount to the good, at 3⅛. Brush ordinary stock, at 25, retained the advance of 8½ points which followed a report concerning the imminence of a reconstruction scheme; this, it is somewhat vaguely suggested, will involve new financing. A tendency towards lower prices for General Electrics at 76s. 6d., Crompton Parkinsons at 26s. 3d., and a few others, reflected a pause in business immediately before the Chancellor's speech.

Dividend Declarations

For some time the price of Ever Ready shares has suggested little confidence in the likelihood of this year's distributions to shareholders being on the same scale as before. Consequently, expectation was prepared for the omission, in last week's announcement, of the 10 per cent. cash bonus which had accompanied the previous final dividend, and the price of the shares remained—like the dividend—unaltered. To take the edge off any disappointment felt in the smaller full distribution there is the preliminary statement that the amount of net profits has been more than maintained, and a declaration that world conditions have influenced the dividend decision. At 24s. Ever Ready shares yield £7 6s. per cent. on the 35 per cent. distribution.

Johnson and Phillips' shares have lately been on the upgrade in anticipation of a good dividend and report. In the event, these proved to be up to best expectations, as regards both the increase in the dividend from 10 per cent. to 12½ per cent. and the expansion of profits. At the advanced price of 42s. the shares show a yield of practically 6 per cent. on the new dividend rate.

American Affairs

The important part played by Wall Street in the behaviour of our own markets has again been unhelpful during the week. For the moment, dollar stock prices are receding after a brief advance brought about by hopes of a revision of those taxes which business interests claim to be a cramping of enterprise. Mr. Roosevelt's plan to rescue trade by vast spending and credit schemes has left the markets coolly sceptical. Few people doubt that injections of the kind contemplated into the industrial system could fail to have some revitalising effects. Far more popular, however, would be measures to restore general confidence, without which, it is thought, there will be no disposition on the part of private enterprise to take up the running as the Government's efforts ease off. In that event, the administration's plans to set the ball rolling again might end—as they have before—in costly failure.

Stock on Offer

Recent publication of the annual report of Allen West, the manufacturers of electrical control and switchgear, showed a large advance in profits, and a return of the ordinary shares to the dividend list. A line of the 4½ per cent. first mortgage debentures is now on offer at a price of 99½, at which the yield is £4 11s. per cent. on the money. A 1½ per cent. cumulative sinking fund, coming into operation this year, will be applied in the redemption of the stock by 1968, through purchase up to, or drawings at, 101. Repayment may also be made at 105 until 1942, or at 102½ afterwards. Annual interest on the £225,000 stock in issue was covered about seven times over by the profits shown in the report for 1937.

Share List of Electrical Companies

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. Previous.	Dividend. Last.	Price April 26.	Rise or Fall.	Yield p.c. £ s. d.
Bournemouth and Poole	1	15	15	63/9	—	4 14 4
City of London	1	7½	7½	34/–	—	4 8 3
Clyde Valley	1	7	8	42/–	+1/–	3 16 1
County of London	1	10½	10½	49/–	—	4 5 7
Edmundson's 7% Pref.	1	7	7	32/–	—	4 6 2
Do. Ord.	1	8	9	37/–	—	4 17 3
Elec. Dis. Yorkshire	1	9	9	40/6	—	4 9 0
Elec. Fin. and Securities	1	12½	12½	48/9	—	5 2 6
Elec. Supply Corporation	1	11	12	51/3	—	4 13 8
Lancs Light and Power	1	7½	7½	32/6	—	4 12 4
Lond. Assoc. Electric	1	—	7	30/–	—	4 13 4
London Electric	1	8	7	35/6	—	3 19 0
London Power Deb. Red.	Stock	5	5	105	—	4 15 3
Metropolitan	1	10	12	48/6	—	4 19 0
Midland Counties	1	7½	8	36/–	—	4 9 0
Mid. Elec. Power	1	8	9	38/9	—	4 13 0
North Eastern Electric Ordinary	1	6	7	30/6	—	4 11 10
Do. 7% Pref.	1	7	7	31/6	—	4 9 0
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary	1	10	10	46/3	—	4 6 6
Do. do. 6% Pref.	1	6	6	29/–	—	4 2 9
Scottish Power	1	8	8	36/–	+6d.	4 9 0
South London	1	7	7	32/–	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	18/9	—	8 0 0
Yorkshire Elec.	1	8	8	39/6	+6d.	4 1 1

PUBLIC BOARDS.

Central Electricity, 1950–70	Stock	5	5	113	—	4 8 6
Do. 1955–75	,,	5	5	114	–½	4 7 9
Do. 1951–73	,,	4½	4½	109	—	4 2 7
Do. 1963–93	,,	—	3½	99	—	3 10 8
London Elec. Trans. Gtd.	,,	—	2½	92	—	2 14 4
London & Home Counties, 1955–75	,,	4½	4½	112	—	4 0 4
London Passenger Transport, A	,,	—	4½	118½	—	3 16 0
Do. do. B	,,	—	5	120½	—	4 3 0
Do. do. C	,,	4	4½	79½	—	5 7 0
West Midlands Joint Elec. 1948–68	,,	—	5	112	–½	4 9 3

TELEGRAPH AND TELEPHONE.

American Tel. & Tel.	$160	9	9	127½	—	7 1 2
Anglo-Am. Tel. Pref.	Stock	6	6	107½	—	5 11 7
Do. Def.	,,	1½	1½	26½	—	5 13 2
Cable & Wireless 5½% Pref.	,,	4½	5½	102	+1	5 8 0
Do. Ord.	,,	—	4	60½xd	—	6 12 3
Do. Income	,,	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	14½	—	3 17 2
Do. do. Pref.	10	6	6	13½	—	4 10 7
Great Northern Tel.	10	20	20	35½	—	5 12 8
Marconi-Marine	1	10	7½	25/–	—	6 0 0
Oriental Telephone Ord.	1	12*	12*	2½xd	+ 1/8	4 7 3

HOME AND FOREIGN TRAMS, ETC.

Anglo-Arg. Trams First Pref.	5	Nil	Nil	6/3	—	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	13	—	—
British Electric Traction Def. Ord.	,,	5	5	100	+50	—
Do. do. Pref. Ord.	,,	8	8	160	+5	5 0 0
Brazil Traction	$100	70 cts.	$1	12½	+1¼	—
Brit. Columbia Elec. Rly. Pcc.	iStock	5	5	99½	—	5 0 6
Mexican Light Common	$100	Nil	Nil	1	—	—
Do. 1st Bonds	$500	5	5	25	—	—
Victoria Falls Ord.	1	20	12	3 1/8	—	3 18 4
West Riding	1	6½	10	2	+⅛	5 0 0

MANUFACTURING COMPANIES.

Aron Electricity Ord.	1	15	15	1⅞	—	8 0 0
Assoc. Elec. Ord.	1	10	10	39/6	—	5 1 3
Do. Pref.	1	8	8	38/–	—	4 4 6
Babcock & Wilcox	1	10	10	40/–xd	+1/–	5 0 0
British Aluminium Ord.	1	10	12½	52/–	—	4 16 2
British Insulated Ord.	Stock	20	20	4 7/8	+ 1/8	4 10 1
Brush Ord.	Stock	Nil	Nil	25	—	—
Callender's	1	15	15	4⅞	+⅛	3 8 6
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord.	5/–	12½	12½	26/3	– 1/8	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	32/6	—	6 3 1
Enfield Cable Ord.	1	25	25	2½	—	—
English Electric	1	Nil	10	30/6	+6d.	6 11 4
Do. Do. Pref.	1	6½	6½	25/6	+6d.	5 2 0
Ericsson Tel.	5/–	25	25*	2	+⅛	3 2 6
Ever Ready	5/–	45	35	24/–	—	7 6 0
Ferranti Pref.	1	7	7	27/6	+⅛	5 2 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	76/6	–6d.	4 11 7
Henley's	5/–	15	20	20/–xd	—	5 0 0
Do. 4½% Pref.	1	4½	4½	1½	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	10	12½	42/–	+2/9	5 19 1
Lancashire Dynamo	1	20	25	3½	+⅛	8 0 0
Siemens Ord.	1	6	7⅞	30/–	+⅛	5 0 0
Telegraph Construction	£1	7½	10	37/6	—	5 6 8

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings will be taken.

1935

35651. "Dry batteries." H. Prince and M. MacCallum (legal representatives of F. MacCallum, deceased) and A. H. Redfern. June 24th, 1936. (482363.)

1936

17714. "Ignition systems and cables therefor." S. F. Mashbir. June 25th, 1936. (482374.)

18123. "Illumination of dials of instruments and other surfaces." Bendix Aviation Corporation. July 1st, 1935. (482595.)

18305. "Resistors." International Resistance Co. July 19th, 1935. (482649.)

23440. "Actuating mechanism for electric motor controlling devices." British Thomson-Houston Co., Ltd., and J. R. Tole. August 26th, 1936. (482509.)

23489. "Oscillatory electric circuits." E. L. C. White and A. B. Blumlein. August 27th, 1936. (482370.)

26417. "Shaped bodies for electric purposes, particularly leading-in wires and bars for electric current." Naamlooze Vennootschap Molybdenum Co. December 12th, 1935. (482586.)

26418. "Electric switchgear." A. Reyrolle and Co., Ltd., and J. A. Harle. September 29th, 1936. (482444.)

26428. "Electric cooking apparatus." T. Kleinert. July 3rd, 1936. (482588.)

26432. "Electrical signalling systems." Automatic Electric Co., Ltd. (in liquidation) and P. N. Roseby. September 29th, 1936. (482445.)

26451. "Electric winder equipment for mine hoists," G. D. Smith, H. N. George, and Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1936. (482448.)

26452. "Winder control gear for mine hoists." G. D. Smith, H. N. George, and Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1936. (482449.)

26453. "Protective apparatus for electrically driven winding, hauling and like gear." G. D. Smith, and Metropolitan-Vickers Electrical Co., Ltd September 29th, 1936. (482450.)

26454. "Electrically driven winding, hauling and like equipments." G. D. Smith, H. N. George, and Metropolitan-Vickers Electrical Co., Ltd. September 29th, 1936. (482451.)

26501. "Deflecting means for cathode-ray tubes or the like." Fernseh Akt.-Ges. September 30th, 1935. (482513.)

26531. "Device for counteracting the effects of electrical forces induced in railway systems by electro-magnetic brakes." Freins Jourdain Monneret. September 30th, 1935. (482589.)

26569. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. October 2nd, 1935. (482518.)

26582. "Synchronous electric generators or installations employing them." Allgemeine Elektricitäts Ges. October 11th, 1935. (482453.)

26670. "Electric steam generators or superheaters for high pressures and temperatures." Siemens-Schuckertwerke Akt.-Ges. October 1st, 1935. (482715.)

26681. "Radio direction-finders." E. J. Hefele. October 2nd, 1935. (482717.)

26747. "Thermionic-valve circuits." J. H. O. Harries. October 2nd, 1936. (482719.)

26773. "Thermionic valves and circuits." J. H. O. Harries and E. G. Autie. October 2nd, 1936. (482591.)

26780. "Electric motors." British Thomson-Houston Co., Ltd., and L. D. Anscombe. October 2nd, 1936. (482381.)

26784. "Gain-regulating arrangements for electrical signalling systems." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.) October 2nd, 1936. (482382.)

26788. "Installation for the generation of electric currents for medical purposes." L. Schulmeister. October 2nd, 1935. (Cognate application 26789/36.) (482720.)

26809. "Electric-light fittings and convection-heaters." G. J. Berry and C. A. Painton. October 2nd, 1936. (482523.)

26815. "Light-modulating devices and electrical circuits for use therewith." Scophony, Ltd., J. Sieger and J. H. Jeffree. October 2nd, 1936. (482665.)

26829. "Electric fires and other electric heating appliances." G. H. Collins and H. F. Collins. October 3rd, 1936. (482383.)

26837. "Electric bells." G. E. Folkes (J. Kastl). October 3rd, 1936. (482592.)

26894. "Generators of relaxation oscillations." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. October 4th, 1935. (Cognate application 26895/36.) (482724.)

27108. "Control systems for direct-current electric motors." General Electric Co., Ltd., and E. H. Croft. October 6th, 1936. (482384.)

27112. "Thermionic tetrodes." M-O Valve Co., Ltd., and L. R. G. Treloar. October 6th, 1936. (482385.)

28228. "Electron multipliers." Ferranti, Ltd., M. K. Taylor and S. Jackson. October 16th, 1936. (482454.)

28597. "Indicating the electrolyte level in electric accumulators." Chloride Electrical Storage Co., Ltd., and H. Dean. October 21st, 1936. (482600.)

28820. "Multiple fuse plugs." W. W. Triggs. (Indicator Corporation.) October 23rd, 1936. (482457.)

28979. "Electric condensers." Steatit-Magnesia Akt.-Ges. December 12th, 1935. (482459.)

29557. "Electron-discharge devices." Standard Telephones & Cables, Ltd. January 23rd, 1936. (482461.)

29995. "Electric lighting or signalling apparatus." Chance Bros. & Co., Ltd., L. B. H. Hallett and N. A. W. Stacey. November 4th, 1936. (482601.)

30149. "Apparatus for temporarily laying electric cables." I. T. Kempe. November 5th, 1936. (482603.)

30161. "Synchronous electric motors." British Thomson-Houston Co., Ltd. November 6th, 1935. (482463.)

31223. "Electric lighting fittings for surgical or industrial operations." O. C. Jones. November 16th, 1936. (482607.)

32147. "Commutators for electric machines." A. E. Edwards. (Naamlooze Vennootschap Maatschappij tot Beheer en Exploitatie van Octrooien.) November 24th, 1936. (482608.)

33167. "Electrolytic processes for the manufacture of magnesium." D. Gardner. December 3rd, 1936. (482678.)

33311. "Electrolytic processes for the manufacture of beryllium." D. Gardner. December 4th, 1936. (482468.)

33435. "Electricity prepayment meters." Sodeco Soc. des Compteurs de Geneve. December 26th, 1935. (Addition to 383343.) (482469.)

33542. "Electric resistance welding machines." A. J. Thorneloe. December 7th, 1936. (482470.)

33987. "Heating elements for thermionic cathodes." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) December 10th, 1936. (482471.)

34329. "Electric spot-welding machines." G. H. Taylor, S. Crawshaw, and Metropolitan-Vickers Electrical Co., Ltd. December 14th, 1936. (482472.)

35396. "Metal-vapour electric-discharge lamps." Siemens Electric Lamps and Supplies, Ltd., and J. N. Aldington. December 24th, 1936. (482625.)

35733. "Electric supply systems." C. Westway. December 30th, 1936 (482534.)

1937

682. "Handling and feeding wire carrying electro-magnetic sound records." L. S. Wallis. January 9th, 1937. (Cognate application 18549/37.) (482536.)

1518. "Electric liquid-break circuit-breakers." General Electric Co., Ltd., and F. J. Keeley. January 18th, 1937. (482629.)

3487. "Mounting the cathodes in electric-discharge devices." General Electric Co., Ltd. (Patent-Treuhand-Ges. für Elektrische Glühlampen.) February 5th, 1937. (482540.)

5440. "Electric boiling vessels." Siemens-Schuckertwerke Akt.-Ges. February 27th, 1936. (Cognate application 5441/37.) (482544.)

5466. "Electro-magnetically controlling the output of air or gas compressors." J. R. Hoerbiger and A. Hoerbiger (trading as Hoerbiger and Co.). February 24th, 1936. (482686.)

5972. "System of protection for liquid-insulated electrical apparatus." M. Buchholz. February 27th, 1937. (482634.)

7073. "Electrical couplings." J. Bowthorpe and Goodliffe Electric Supplies Ltd. March 10th, 1937. (482636.)

9190. "Electric deposition of resin films." British Thomson-Houston Co., Ltd. April 1st, 1936. (482548.)

11713. "Castings for electric batteries." C. M. R. Balbi. April 23rd, 1937. (482550.)

13318. "Thermionic discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. May 13th, 1936. (482552.)

15595. "Electric-discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. June 12th, 1936. (482557.)

17881. "Low-frequency induction furnace." Hirsch Kupfer- und Messing-Werke Akt.-Ges. June 27th, 1936. (482560.)

18339. "Electronic power-amplifier." L. L. De Kramolin. July 3rd, 1936. (Addition to 415079.) (482561.)

18349. "Electrically heated domestic ovens or cookers." Falk, Stadelmann and Co., Ltd., and J. W. Campbell. July 2nd, 1937. (482415.)

18868. "Protecting aluminium and its light allows by electrolytic deposition." A. G. Chaybany. July 7th, 1936. (482563.)

19279. "Generators of relaxation oscillations." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. October 4th, 1935. (Divided out of 482724.) (482725.)

20655. "Methods for the automatic control of the level in carrier-frequency telegraph systems." Siemens and Halske Akt.-Ges. July 24th, 1936. (482569.)

22007. "Guided electro-magnetic wave transmission. Standard Telephones and Cables, Ltd. October 31st, 1936 (482420.)

22562. "Electric screen-wipers." E. Brumm. August 17th, 1936. (482697.)

24050. "Electro-magnetic couplings." Maag-Zahnraeder und Maschinen Akt.-Ges. September 7th, 1936. (482497.)

24879. "Metal vapour electric convertors." Siemens-Schuckertwerke Akt.-Ges. September 11th, 1936. (482424.)

26853. "Methods of producing insulating materials." British Thomson-Houston Co., Ltd. October 7th, 1936. (482701.)

28632. "Cathode-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 23rd, 1936. (482704.)

32495. "Salient pole-pieces for dynamo-electric machines." Westinghouse Electric and Manufacturing Co. November 28th, 1936. (482506.)

Trade Mark Applications

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 20th:—

Tensovic. Nos. 583561 and 583563. All goods in Classes 6 and 13.—Metropolitan-Vickers Electrical Co., Ltd., 1, Kingsway, W.C.2.

Anotec. No. 584471. All goods in Class 6.—Anodising and Plating, Ltd., 14, Bolton Street, Piccadilly, W.1.

Miniwatt. No. 581665. Class 8. Wireless telephonic and telegraphic receiving apparatus and parts thereof, thermionic valves, radio-gramophones, apparatus for rectifying electric current, sound amplifying apparatus, microphones, electric light measuring instruments, electric current and voltage indicators, current transformers, and photo-electric cells.—Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.

Partridge Pressure Indicator. No. 581955. Class 8. Instruments consisting mainly of insulated air condensers for denoting the existence of pressure of electric current.—Westminster Engineering Co., Ltd., Victoria Road, Willesden Junction, N.W.10.

Asuna. No. 583514. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Naamlooze Vennootschap Siera Radio, Venlo, Holland (British representatives: Dicker, Pollak, Mercer, Tench and Meyer, 20-23, Holborn, E.C.1).

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aldridge.—Houses (230), Bridle Lane and Aldridge Road, Streetley; Eborall Estates, Ltd.

Batley.—Houses (70), Healey; borough surveyor.

Bexhill-on-Sea.—Gymnasium, Little Common Road; Callow & Callow.

Blairgowrie.—Cinema; Maxwell, Stewart & Maxwell, architects, Glasgow.

Bridlington.—Houses (118), various villages; C. F. Johnson, housing architect, Midland Bank Chambers, Westgate.

Brighton.—Flats, St. Mary's estate (£38,600) and Nelson Street (£20,247); borough engineer.

Bristol.—Cinema and café, White Court Cross estate, Wells Road; Nidditch & Macdonald, architects, Aylmer Parade, Highgate, London, N.

Bury St. Edmund's.—Reconstruction of Bury and West Suffolk Hospital (£35,000).

Cardiff.—Houses (100), Highmead estate, Ely; Estates Committee.

Cheshire.—School, Stone Hills estate, Runcorn, for the County E.C.; F. Anstead Browne, county architect, The Castle, Chester.

Chester.—School and enlargement of college for the Chester Diocesan Church Schools Association. Extensions to Dee House Ursuline Convent school; governors.

Chester-le-Street.—Council Offices; R.D.C. surveyor.

Church Eaton.—Small holdings, Woollaston Farm (£16,535), for Staffordshire C.C.

Cleckheaton.—Houses (56), Heckmondwike and Holme Lane End Road; Jackson Foster, builder, Birkenshaw.

Darenth.—Extensions to L.C.C. Institution (£32,425); H. C. Horswill, Ltd.

Darlington.—Cinema, Cobden Street; J. H. Morton and Son, architects, Martins Bank Chambers, Fowler Street, South Shields.

Dorset.—School, Weymouth (£41,018); county architect.

Durham.—School, Dunston-on-Tyne, for the County E.C.; F. Willey, architect, 34, Old Elvet, Durham City.

Ealing.—Houses (192), Kingshill Avenue, and etc.; T. F. Nash Construction, Ltd., Uxbridge Road, Hayes.

Epsom.—Houses (200), near Cox Lane, Ewell (£83,790); U.D.C. surveyor, Epsom.

Folkestone.—Flats (36), Cheriton Road; R. R. Gordon-Barrett, 71, Sandgate Road.

Gateshead.—Factory for Hampshire Brick Co., Ltd.; L. J. Couves & Partners, architects, Carliol House, Newcastle-on-Tyne. Factory for Cadbury Bros., and extensions to factory, for Barran & Co., Ltd.; Cackett, Burns Dick and McKellar, architects, 26, Ellison Place, Newcastle-on-Tyne.

Glastonbury.—Alterations to factory, for R. J. Draper & Co., Ltd., Chilkwell Street.

Gloucester.—Houses (216), Coney Hill estate (£108,400); city engineer.

Gosport.—School, Privett Road (£32,200), for the E.C.; education architect.

Hertfordshire.—Sessions House, Hitchin (£14,730); county architect.

Ilford.—School, Lord Avenue; L. E. J. Reynolds, education architect, Town Hall.

Kidderminster.—Houses (48), Queen Street; borough engineer.

Lanarkshire.—Renovation of Bellshill Alhambra Cinema; G. Palmer, chairman of the company.

Leeds.—Houses (20), Dewsbury Road; S. G. Wilkinson & Sons. Cinema, Gipsy Lane; F. R. Evans, 3, Waterloo Street. Flats (80), Camp Field estate (£44,910); Simms, Sons & Cooke, Ltd. Stores and offices, Briggate, Trinity Street and Nelsons Yard; Sir Henry Phillip Price. Schools, Belle Isle estate; city architect.

Lewes (Sussex).—Houses (50), Highdown Road; Ringmer Building Works, Ltd., building contractors, Ringmer, near Lewes.

Lincolnshire.—Enlargement of Grammar school, Spalding (£25,713), for the Holland E.C.

Llanelly.—Houses (112), Lliedi estate (£76,480); borough engineer.

London (Kensington).—Shops and flats, 266-268, Earl's Court Road, for W. H. Smith & Son, Ltd., Strand House, W.C.2. (Poplar).—Electricity showrooms and offices, East India Dock Road, E.14; R. J. Williams, borough engineer, Poplar High Street, E.14. (Brixton).—Factory, Coldharbour Lane; H. P. Wyatt, architect, 465, Brixton Road, S.W.9. (Hackney).—Tenements, Hindle Street (£69,667); Gee, Walker & Slater, Ltd. (Stoke Newington).—Redevelopment of old Town Hall site (£20,640), including accommodation for branch library, child welfare centre, community centre and air-raid precautions training; borough surveyor.

Merthyr Tydfil.—Munitions factory (£1,000,000), for I.C.I., Ltd.

Middlesbrough.—Houses, near Cargo Fleet Lane, for H. W. Pilkington, and Hutton Road, for W. H. Causier; H. Moore, architect, 61, Albert Road. Houses, north of Levick Crescent; W. A. King and Son, builders, Westbourne Grove, North Ormesby. Offices, Borough Road, for the A.E.U.; A. Ross, district organiser, 17, Linthorpe Road. Stores, Clifton Street, for Middlesbrough Co-operative Society; C.W.S. Architects' Dept., 90, Westmorland Road, Newcastle-on-Tyne.

Middleton.—Houses (32), Brassey Street, Lord Street and Wagstaff Street; D. Rees, Dartmouth Road, Chorlton-cum-Hardy. Houses, Moorclose estate, and Rhodes; borough surveyor.

Mill Hill.—Houses (220), Dole Street and Bittacy Rise; W. F. Thorpe, architect, 26, The Broadway, Mill Hill.

Muirkirk (Ayrshire).—Cinema, site of Dundas Hall, for the Glebe Cinema Co., Ltd., Lesmahagow.

Murton Colliery (Co. Durham).—Houses (88), for Easington R.D.C.; T. D. Gibbons & Sons, contractors, 5, Hendon Burn Avenue, Sunderland.

Newcastle-on-Tyne.—Library (£13,400), Brinkburn Street, for the City Council; A. Anderson, Ltd., builders, Stanmore Road.

Northampton.—Showrooms and garage, Victoria Promenade and Cattle Market Road, for the Town and County Motors (Northampton), Ltd., Bridge Street; E. R. Danford, architect, Imperial Chambers, Newland, Northampton.

Northern Ireland (Belfast).—Building (£12,000), for Nervous Diseases Hospital and Epileptic Colony, Claremont Street. Offices and workshops, Queen Street (£80,000), for Belfast City and District Water Commission; Barnish, Silcock & Thearle, architects, 58, Rodney Street, Liverpool, 1.

North Shields.—Factory, West Chirton, for Welch & Son, and Norham Terrace, for the Great Northern Knitwear Co.; H. D. Burton, Ltd., builders, King Street, North Shields.

Northumberland.—School, Morpeth (£25,660), for the County E.C.

Oundle.—Houses, Ringstead, King's Cliffe, Glapthorn, for Oundle and Thrapston R.D.C.; F. J. Short, surveyor, Council Offices, Thrapston.

Paignton.—Houses (12), near All Hallows Road; A. J. Proctor.

Portsmouth.—Factory, Baffins; Marchetti, Ltd. Factory, Langstone Harbour; Vosper, Ltd.

Redcar.—Houses (68), Boulby Road; Westfield Estates, Ltd.

Romiley.—Houses (118), George Lane; H. Roper, Silverdale, Bredbury.

Ross-on-Wye.—Houses (56), Three Crosses estate (£23,304); U.D.C. surveyor.

Rugby.—Houses (79), Millfields estate; Allcock & Sisson, Hill Top, Eastwood, Nottinghamshire.

St. Helens.—Houses (52), Greenbank estate (£20,972); borough engineer.

Seaton Valley.—Offices, for the U.D.C. (£11,000); T. E. Ridley, builder, 7, Moor Crescent, Gosforth.

Shalford (Surrey).—Estate development, East Shalford Lane; Hiscock & Morreau.

South Shields.—Cinema, Marsden, for Shephard & Thompson; J. H. Morton & Sons, architects, Martin's Bank Chambers, Fowler Street.

Stanley (Co. Durham).—Houses (86), Craghead, for the U.D.C.; A. Routledge, surveyor.

Stourport-on-Severn.—Houses (109), Manor Farm scheme; Pritchard, Godwin & Clist, architect, Bank Buildings, Kidderminster.

Sunderland.—Houses (316), in the east end; borough engineer. Isolation block for Infectious Diseases Hospital (£12,222); J. Huntley & Sons, Ltd., builders, Marion Street.

Swadlincote.—Houses, near Oversetts Road, Newhall; U.D.C. surveyor.

Thedwastre.—Houses (28), nine parishes, for R.D.C.; Hunt & Coates, architects, 51a, Abbeygate Street, Bury St. Edmund's.

Thornaby-on-Tees.—Houses, Mansfield estate, for H. Cohen; G. P. Stainsby, architect, 25, High Street, Stockton-on-Tees.

Todmorden.—Houses (56), Heptonstall; R.D.C.

Torquay.—Houses (188), Watcombe estate; P. W. Ladmore, borough engineer, Town Hall.

Tredegar.—Houses (28); U.D.C. surveyor.

Tynemouth.—Houses (10), Balkwell Avenue; Haswell & Son. Houses (10), Links Avenue; J. R. Wallace. Extensions to Town Hall, Norfolk Street; borough engineer. Extensions to Tynemouth Jubilee Infirmary, for governors; Cackett, Burns Dick and McKellar, architects, 21, Ellison Place, Newcastle-on-Tyne.

Urmston.—Houses, Gregory House Farm, Irlam Road and Church Road estates; E. L. Leeming, U.D.C. surveyor, Council Offices, Crofts Bank Road, Urmston.

Walthamstow.—Rebuilding of Connaught Hospital, Orford Road (£160,000); W. Stewart, architect, Fenchurch Street, London, E.C.3.

Warwickshire.—School, Chapel Fields, Solihull (£25,731), for the County E.C.

Wembley.—Flats (39), junction of Church Lane and Elthorn Road, Kingsbury; borough treasurer and accountant, 117a, High Road, Wembley.

West Bromwich.—Extensions to works, for Chance Bros. & Co., Ltd., Oldbury Road.

West Hartlepool.—Houses, Kent Street, for the Durham and Northumberland Real Estate Co., Ltd.; Heslop and Johnson, architects, Church Square, West Hartlepool. Houses (52) and shops, for the T.C.; G. Fordy and Son, builders, Boathouse Lane, Stockton-on-Tees.

Wigan.—Cinema, Bryn Street, for T. Atherton.

Wood Green.—Factory, for R. W. Munro, Ltd., Cline Road; Yates, Cook & Darbyshire, 43, Great Marlborough Street, W.1. Factory, for E. Tearle, Ltd., Cline Road; S. Clifford, Tee & Gale, Moorgate Hall, Moorgate, E.C.2. Additions to screw factory, Brook Road; Davis & Timmins, Ltd., Brook Road, N.22. Additions to Television Studios, Alexandra Palace; British Broadcasting Corporation.

Wrexham.—Extensions to Wrexham and East Denbighshire War Memorial Hospital; F. A. Roberts, architect, Earl Chambers, Mold.

Yorkshire.—Schools, South Avenue, Redcar, and Ecclesfield, near Sheffield, for the West Riding E.C.